ELECTRICAL REVIEW

[ILLUSTRATED.]

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Accumulator-Electrodes.

By Emile Reynier, in "L'Electrician."

Although strongly attacked by certain electricians, the new chemical theory of accumulators which I have put forward in this journal, is at present generally accepted. No objection, based upon experiment, has been urged against it; on the contrary, facts daily testify in its favor. Thus, MM. Crova and Garbe have experimentally proved the fixation of one equivalent of sulphuric acid upon each electrode during the discharge, and M. Tscheltgow, after having measured the formation heat of the peroxide of lead, has furnished the new theory with a thermo-chemical verification which was otherwise foreseen.

It is known that I did not wait for these late confirmations to admit double sulphatation in the solution of the problems raised by the rational construction of electric accumulators. The new chemical theory has also given me the means of calculating the augmentation of the bulk of the electrodes by *formation* and by discharge, phenomena which I have designated by the name of *increases*.

The study of increases finds, in turn, its practical application in the manufacture of folded accumulator plates. These expansions, which were formerly injurious, will in future improve and accelerate the formation of the plates.

My old folded accumulators, Fig. 1, if the formation was carried too far, took a fan-shaped development, Fig. 2, which was clumsy and inconvenient, the electro-chemical capacity of the accumulator was far from increasing in proportion to the quantities of increased matter; a proof that these substances took little part in the reactions of the discharge.

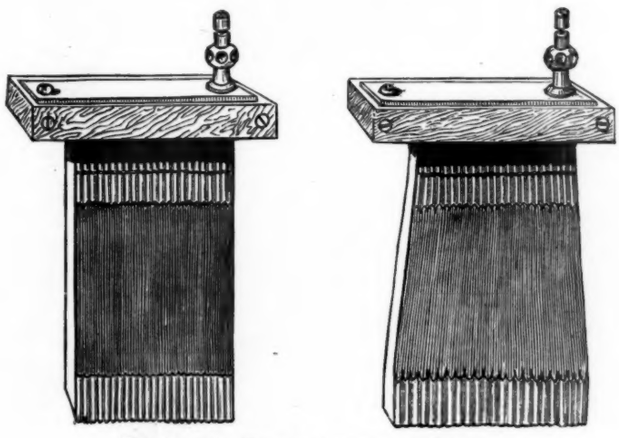
I thought that by limiting the lateral expansion, I should produce an energetic compression of the superficial dust against the inner sides of the folds, and that these substances thus compressed against their conductive support, would enter better into activity. I obtained, in fact, more limited expansions and higher electro-chemical capacities by connecting to each other the folds of the electrodes by means of transverse autogenous solderings. But the resistance of the accumulator increased because the liquid had difficulty in penetrating to the interior of these deep and compressed folds. The autogenous solderings were also difficult and costly.

These difficulties disappear in the new electrode, with a cast frame, Fig. 3.

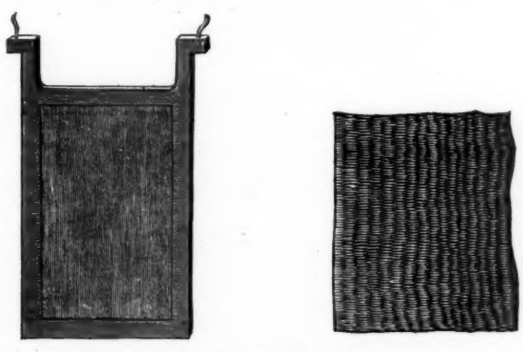
The active portion of this electrode consists of a band of rolled lead of 0.95 meter long, 0.16 meter wide, and ½ millimeter thick. This band is then *striated* by passing between the rollers of a special laminator, which imprints upon it shallow marks at little distances from each other, Fig. 4; it is then perforated by some sloping slits, and then folded mechanically.

The folded plate, thus obtained, is introduced into a cast-iron mould, which leaves a suitable emptly space around it. Melted lead is poured into the mould, so as to form the frame and solder it on all sides to the structure which it surrounds. External prolongations of cast-iron serving as a conductor and a support to the electrode, come in contact with the frame, and form one body with it.

The cast frame is thus a physical and mechanical connection for all parts of the electrode, more solid than the ribs of the old plates. It resists the transverse expansion, and effects an energetic compression of the superficial pulverulent materials which



Figs. 1 and 2.—Reynier Accumulator Plates.



Figs. 3 and 4.—Showing New Reynier Electrodes.

are thus brought into close and extended contact with the conductive portions of the plate.

The following are some numerical data of the new pattern electrode:

Width of plate.....	130 mm.
Total height.....	245 "
Thickness.....	5 "
Weight of folded part...	900 grammes.
Total weight.....	1,500 "
Outer surface of electrode	5 sqr. dec. m.
Total developed surface..	45 " "
Total effective surface....	35 " "
Corresponding electro-chemical capacity.....72,000 coulombs.	

We see that the weight of the active portion seems to be three-fifths of the total weight; in reality, the fraction is greater, because the material of the frame is far from being completely inert. I could make a frame lighter by one half, but I prefer to exaggerate the solidity of the system.

The electro-chemical capacity depends, naturally, on the degree of formation; the figure given is not a maximum.

The formation is effected by the procedures of M. Gaston Plante. It is very rapid, especially if we previously attack the folds with nitric acid, according to the indications of this eminent physicist. The structure of the new plate enables the operation to be pushed very rapidly, as we have not to fear the fall of superficial matter, which is retained very energetically between the wrinkled surface by compression.

The mutual distance of the folds is regulated in such a manner that the mean density of the active portion is equal to 8. The density of compact metallic lead being 11.4, the folds leave at first a certain play-room between them; but the formation fills up the empty spaces, and cements the laminæ together. Thus the plate acquires a solidity which speaks well for its lasting power.

The 160 folds distributed over the width of the plate give it, however, in the transverse direction a sufficient elasticity to facilitate the very slight alternate movements of expansion and contraction required by the increase on charging and discharging.

The cast frame secures the mechanical solidity of the entire structure, so that the attackable surface of the active portion may be much increased by employing very slender sheet-lead. But the metal undergoes very high plus values when its thickness gets below ½ millimeter. I have, therefore, stopped at this thickness for electrodes commonly made.

If it is desired, for special reasons, to increase very greatly the attackable surface of the active lead, we may with economy have recourse to another system of plates, which I will describe in an early number.

The U. S. Postal Telegraph.

Senator Edmunds, it is believed, will not be satisfied when Congress meets, by the mere introduction and reference to the proper committee of his bill providing for the establishment of a postal telegraph, but will push the bill to consideration, and if possible to a vote. Senator Edmunds' idea is to create a board, consisting of the Secretary of State, the Secretary of War and the Postmaster General, whose duty it shall be to lay out four trunk lines connecting the northeastern, the northwestern, the western and southwestern and the southern parts of the United States with the city of Washington. Along these trunk lines connections are to be made and telegraph offices established according to the demands of the service. The postal telegraph is to form part of the postal system, and the rates are to be fixed from time to time by the board already mentioned. The lines are to be constructed and kept in repair under the direction and superintendence of the Secretary of War and through the Corps of Engineers. The Secretary of War is to be authorized to acquire by purchase, subject to the approval of the President, the right of way for the lines and their extensions. Damages, if disputed, are to be referred to the Court of Claims for assessment, with appeal to the Supreme Court. The Government is also to be authorized to acquire by purchase the stock, machinery, appliances and materials, not including telegraph lines, owned by persons or corporations, which shall be deemed necessary for the operation of the Government lines. In case of a dispute as to the value of such property, the Court of Claims is to arbitrate on the question. Employes in the postal telegraph service are to be appointed according to the provisions of the Civil Service act. Nothing, according to Mr. Edmunds' plan, done by the Government in the matter is to interfere with or prohibit individuals or corporations from carrying on the business of operating telegraph lines.

The Electrical Transmission of Power.

It is scarcely to be expected that the recent experiments of M. Marcel Deprez, which are fully dealt with in our other columns, will excite the same amount of interest—we might almost say sensation—as the results of his previous experiences between Miesback and Munich, Vizille and Grenoble, and other places, notwithstanding the fact that they are of a more grotesque and fantastic character. We are now so conversant with matters involving the transmission of power by electricity that the results obtained through the dogged determination of the French electrician to overcome the many obstacles with

which his path has been beset, will fail to arouse any degree of enthusiasm—at least on this side of the Channel. What with the Portrush tramway, a similar line between Bessbrook and Newry, the telpher system at Glynde, etc., the public has long been convinced that the electrical transmission of power could be readily and successfully undertaken. We do not, of course, intend to lead our readers to think that the operations carried out in this country can compare in magnitude or distance traversed with those of M. Deprez, but we do mean that, had any of our electrical engineers received such support and assistance as has been accorded to him, the same thing could as readily have been accomplished in England in much less time, and, we think, in a manner less open to criticism. We notice that M. Deprez still adopts the plan of putting his apparatus in a looped circuit, and this in itself is enough to make one doubt the accuracy of his tests, unless the line were perfectly insulated, which we need not say could not have been the case. To have obtained the results with which the French engineer credits himself, his generator must have been capable of reproducing nearly 80 per cent. in the external circuit of the mechanical power exerted in driving it, and the recipient must have converted nearly 80 per cent. of the electrical energy received into available power. We have not had M. Deprez's figures before us sufficiently long to enter deeply into the matter here, but in a future issue we shall take occasion to go more fully into an impartial examination of his tabulated results. The idea, however, of separately exciting the field magnets of the motor is an absurdity upon which we need not enlarge, for in practice the motor must decidedly be self-acting in this respect.

We may, in conclusion, state that, so far as we can judge at the present moment, M. Deprez's figures will not bear a careful analysis.—*London Electrical Review.*

A Reason Why Boilers Explode.

Notwithstanding all the progress of modern mechanical science and steam engineering, says *American Machinist*, the number of disastrous boiler explosions seems to be increasing every year. We are told by certain philosophers, in the mechanical line, that these disasters are caused mainly by carelessness in managing the boilers, growing out of the ignorance of the parties owning them. No doubt this is the cause of many explosions, but it is even doubtful if it is the chief cause of such disasters. The buyers of boilers comprise parties in so many different pursuits that it is impossible, with all the spread of mechanical knowledge, that a large part of them should not be dependent upon others for ordinary mechanical information. The parties are not likely to apply to a disinterested mechanical engineer for advice, especially if there is a fee to be paid, and nine times out of ten they accept the dictum of the boilermaker as conclusive. If the boilermaker is thoroughly conscientious, and prizes his reputation, as well as the profit to be made on the contract, his advice will be safe to follow, but such is not always the case. A safe and reliable boiler will cost more than one built of poor material and slighted in workmanship. The latter appears about as well to the inexperienced buyer, and the difference in price, backed with some persuasion on the part of the maker, often determines the sale. These are the boilers that do most of the blowing up, and most of the destruction to life and property, and the men that build them know their liability to disaster.

It is an interesting study to examine the records of boilers sent out from different shops. Some shops there are with a record of hundreds, even thousands, of boilers made and sold without a single explosion being heard of among the whole number. Others with a large production, extending over many years, can discover but one or two cases of explosion. Again we find boiler making establishments that have been quite frequently brought to public attention through disaster to boilers of their manufacture. It is impossible to believe that all the boilers from one builder go into competent and careful hands, while a large part of those from another shop in the same section of the country go into charge of careless and incompetent engineers. It is not mere chance that causes boilers from certain shops to explode, while those from certain other shops remain in service without disaster. It is a usual thing when a boiler blows up, to try and fasten the blame upon the engineer or fireman. Failing in this, the proprietor is generally charged with the whole responsibility. The maker of the boiler is the last person thought of for censure, and in most cases goes scott free, even though the boiler was never a safe or strong one.

The maker of inferior boilers, at low prices, is likely to excuse himself on the ground that he supplies a definite demand that could not be met with safe boilers at higher prices, and that if he does not supply that demand others will do it. This is equal to the logic of the footpad who relieves the traveler of his valuables because another thief is lying in wait for him. If the traveler is certain to be robbed he would be no poorer than if plundered by the second thief, hence the first one quiets his conscience by the thought that he is causing no extra distress. The average grade of engineers, who handle steam machinery, is being elevated every year, but we doubt very much if the average grade of steam boilers is being elevated in the same proportion. There is room for decided improvement in many boiler shops.

* * The Blackstone cotton mills, in Mass., announce an advance in wages of from 14 to 20 per cent. This would indicate an improvement in business.

* * A bill has been presented to the Municipal Assembly of St. Louis, asking that permi-sion be granted H. L. Fox, W. R. Donaldson and R. C. Kerenes, of St Louis, and James W. Chisholm, A. J. Cooper, Frank Butterworth and Isaac E. Adams, to construct and operate, for the term of twenty-five years, the Chisholm-Patterson underground conduit system of wires for electrical purposes to be conducted under the sidewalks and through alleys.

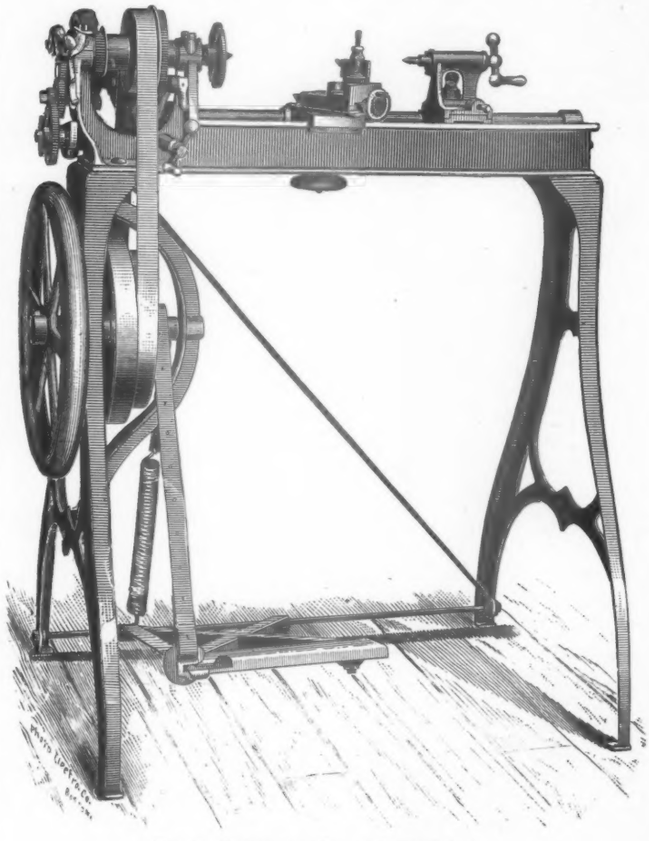


Fig. 1.—Providence Screw Cutting Lathe.

"The Divided Circuit."

At a recent meeting of the Buffalo Electrical Society, Prof. A. L. Arey delivered the following lecture, a report of which was crowded out of our last edition.

The lecturer began by deducing the well-known formula for the resistance of a divided circuit

$$R = \frac{r r^1}{r \times r^1} \qquad (1)$$

in which R = the joint resistance of the two arms, r the resistance of one arm and r^1 the resistance of the other arm, and continued, remarking that in the majority of divided circuits the several arms or branches are of equal resistance, as in the case of the incandescent lamp circuits or of batteries connected in multiple arc. We have in such cases $r = r^1$, and the formula (1) becomes

$$R = \frac{r^2}{Q\,r} = \frac{r}{Q}$$

but Q is the number of branches, and if we let n = the number of branches we write

$$R = \frac{r}{n} \qquad (2)$$

by means of which we may determine the resistance of any devided circuit.

To illustrate the application of this formula the following problem was solved:

What will be the resistance of 900 incandescent lights each having a hot resistance of 130 ohms connected in simple multiple arc?

Substituting in the formula

$$R = \frac{130}{900} = .144 \text{ ohms.} \quad \textit{Ans.}$$

After applying this principle in connection with Ohm's Law to several more complicated problems, Mr. Arey stated that the consideration of a large class of problems seemed to have been overlooked by the various writers on electricity, and gave the following deduction of formulas for the determination of the number of cells of a given battery, which will produce a given current through a given external resistance, and the manner in which they must be connected.

In problems of this kind we have given

C = the current desired.
R = the external resistance.
E = the E.M.F. of the cell.
r = the internal resistance of the cell.

Let

X = number of cells in series.
y = number of rows of cells.
P = internal resistance of battery.
E = the E.M.F. of the battery.

By Ohm's Law we have.

$$C = \frac{E}{P \times r} \qquad (3),$$

but the E.M.F. of the battery is equal to the E.M.F. of one cell multiplied by the number of cells in series, hence

$$E = E X.$$

Substituting in (3)

$$C = \frac{E X}{P + R} \qquad (4),$$

and since the maximum current is obtained from a given battery, when its internal resistance is equal to the external, we may determine the smallest number of cells which will produce the given current by making P = R in equation (4).

hence

$$C = \frac{E X}{Q R} \qquad (5)$$

Clearing of fractions

$$E X = Q C R.$$

$$X = \frac{Q C}{E} R \qquad (6).$$

The resistance of the given battery will be

$$P = \frac{r x}{y} \qquad (7)$$

but since R = P we may write

$$R = \frac{r x}{y} \qquad (8)$$

Clearing of fractions.

$$R y = r x$$

$$y = \frac{r}{R} X \qquad (9)$$

Substituting the value of X found in equation (9) we have

$$y = \frac{r}{R} \times \frac{Q C R}{E}$$

whence

$$y = \frac{Q C}{E} r \qquad (10)$$

And we may obtain the number of cells which must be connected in series by the equation (6)

$$X = \frac{Q C}{E} R$$

And the number of such series by equation (10)

$$y = \frac{Q C}{E} r$$

Of course the number of cells used will be equal to X multiplied by Y.

It is evident from an inspection of the formula that the number of cells in series depends upon the external resistance while the number of such series depends upon the internal resistance of each cell.

In conclusion the following problem was solved to illustrate the application of the formulæ.

How many gravity cells will be required to send a current of 10 amperes through a resistance of 5 ohms and how must they be connected assuming the E.M.F. of each cell=1 volt and its internal resistance 1.5 ohms?

Substituting in (6) and (10)

$$X = \frac{20}{1} \times 5 = 100$$

$$Y = \frac{20}{1} \times 1.5 - 30$$

Therefore the numbers of cells required will be3,000 connected in 30 rows of 100 each.

* * The new amperemeter of M. F. de Lalande is highly commended by our French contemporaries, who lay stress upon the improvement effected by the substitution of an electro for a permanent magnet. The instrument, roughly, consists of a bundle of soft iron wires placed in the interior of a metallic areometer, which latter is inserted in a gauge full of water surrounded by a coil traversed by the current to be measured. Under the action of the current the bundle of wires is attached, and the areometer is more or less displaced according to the strength of the current indicating the value of such displacement upon a scale graduated upon the instrument.

Lathes of the Narragansett Machine Company, of Providence.

The Providence screw-cutting lathe, of the Narragansett Machine Company, of Providence, R. I., which is illustrated in this issue, has been used by numerous electrical experimenters and workers with excellent results. The manufacturers state that it is specially adapted for electrical workers on account of the great variety of speeds that can be obtained, enabling them to turn iron or steel as large as the lathe will swing, or run fast enough to drill a $\frac{1}{16}$ inch hole, or make a screw out of a pin. In winding armatures there is no trouble from the lathe stopping or from being unable to stop it, as the lathe is under complete control from the operator's foot, who can make from a small fraction of a revolution to four or five at one pressure of the foot.

In Fig. 1 is shown the complete lathe. Fig. 2 illustrates part of the new and useful features of this lathe. The gear teeth are represented by heavy black lines. Fig. 3 is a view of the carriage of the foot lathes, showing the bed in section, and is the same in its main features on both screw cutting and hand-feed lathes. Fig. 4 illustrates the improved foot-power of this company's lathe.

Electric Locomotion.

By A. Reckenzaun.

I.

In turning our mind towards that period when electric lighting began to be the all-absorbing theme, when the public at large was startled by the wonderful doings at the other side of the Atlantic, when gas shareholders trembled and electric-light shareholders rejoiced, we are tempted to ask ourselves why the subject of electric locomotion was all but forgotten in the midst of this excitement. Although many of the newly-born limited companies assumed the title of Light and *Power* Company, several managed to spend their money in putting up unsuccessful electric-light installations, whilst few of those who professed to be suppliers of "motive power" ever thought of inquiring into the merits of this subject.

It cannot be said that the field was an unknown one, for the application of electricity as a motive power engaged the attention of ingenious minds long before the incandescent lamp was invented. Salvatore Dal Negro published an account of his experiments with an electro-magnetic machine in the year 1832; Prof. Jacobi gave a description of his first motor in 1834 before the Academie des Sciences in Paris, and he constructed and worked an electric boat in 1839. These experiments were carried out on a large scale, regardless of cost, at the expense of the Emperor Nicholas. Robert Davidson placed an 'electro-magnetic" locomotive on the Edinburgh and Glasgow Railway in 1837; the carriage was 16 feet long, 6 feet broad; it weighed five tons, and ran at a speed of four miles per hour. Numerous other attempts were made, and had to be abandoned, mainly on account of the great cost of the battery power. Dynamo machines were unknown. Electric lighting has received an extraordinarily rapid development with the introduction of the dynamo-electric machine, but this development could not have been so rapid had it not been for the liberal amount of financial support it received. Whatever company promoters and speculators may have made out of the electric-lighting scare, there is no doubt that immense sums were spent on experiments and improvements upon apparatus which were no sooner patented than sold at enormous prices. There were many failures in spite of lavish expenditure of money and brain power—they will soon be forgotten; but the fact remains that electric lighting, from a technical point of view, would not have reached its present state of perfection without that universal support and that large number of intelligent men who helped in perfecting so many details. The very rapidity of progress appeared to justify us in the belief that, apart from the superior quality of the electric light, it would soon be made cheaper than any other illuminant, and, as light is the more universal commodity, this step-sister, "motive power," has been left with a comparatively poor dowry.

Much has been said and written about the vast amount of energy in nature which runs to waste and which *could* be stored, or transmitted electrically to great distances; but in these times of depression in the various manufactures we are more than fully supplied with motive power; moreover, when we come to examine carefully into the prime cost of a water-power installation, and the cost of conductors requisite for carrying the electric energy to the factory, which, for obvious reasons, cannot be erected near the waterfall, we find that the advantages which we expected to derive through this new medium of transmission are not very great. Nevertheless, there are many instances where electricity could be advantageously employed, and especially for the purposes of locomotion. In countries where water power

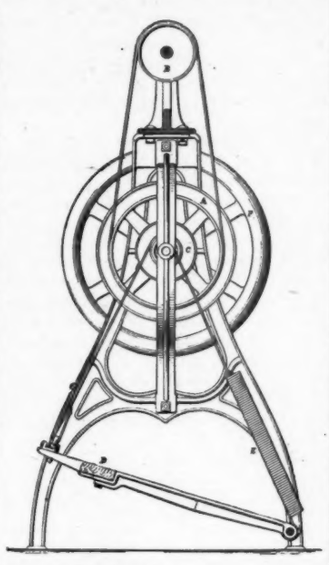


Fig. 4.—Showing Foot Power of Providence Lathe.

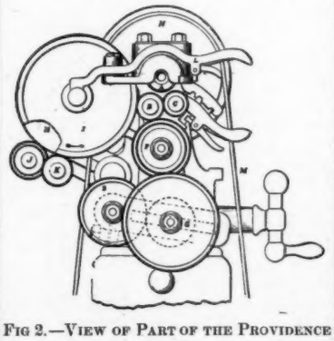


Fig 2.—View of Part of the Providence Lathe.

is plentiful, and coals or other fuel expensive, there we may transmit the electric energy to a distance which is determined by the price of the available fuel, and in most countries where horses are dear, and coals or water power comparatively cheap, there electric locomotion will find a profitable field—we refer to tramways and light railways. There are many instances where neither horses nor steam-engines can be advantageously used, as in underground locomotion, across fields and mountains without proper roads; in the latter case, the new system of electric locomotion, telpherage, will come largely into use. Lastly, electricity as a motive power will and does find applications in boats for pleasure and war purposes, not forgetting its services for experiments with navigable balloons.

Our aim in the following series of articles will be to explain—firstly, the best-known means of producing the electric energy and converting it into mechanical power; secondly, to show how the efficiency of any system may be tested, giving numerical examples of existing applications; and thirdly, the prime cost, maintenance and depreciation, so far as it is in our power to ascertain the same.

Without attempting to wade through the historical part of our subject, it may be interesting to quote a passage or two from a paper "On Electro-Magnetism as a Motive Power," by Robert Hunt, read at the Institution of Civil Engineers, in April, 1857, because in that paper the author draws comparisons between the amount of energy given out by a pound of zinc in a battery and that of a pound of coal in a steam boiler, and as there are people who, at the present day, endeavor (knowingly or unknowingly) to persuade laymen of the wonderful things obtained by means of primary batteries, this digression may be pardoned. There we read: "Mechanical force, whether obtained in the form of man-power, horse-power, steam-power or electrical power, is the result of a change of form in matter. In the animal it is the result of muscular and nervous energy, which is maintained by the due supply of food to the stomach. In the steam-engine it is the result of vapor pressure, which is kept up by the constant addition of fuel to the fires under the boilers. In the magnetic engine it is the result of currents circulating through wires, and these currents

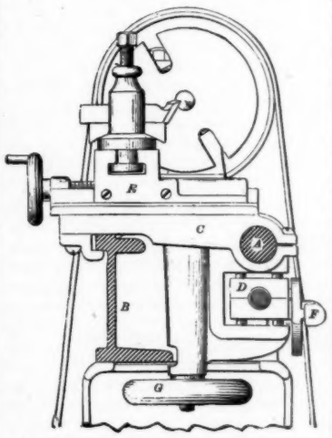


Fig 3.—View of the Carriage of the Providence Lathe.

are directly dependent upon the chemical change of zinc, or of some other metal in the battery. Then—

"Animal power depends on food.

"Steam-power depends on coal.

"Electrical power depends on zinc.

"The heat evolved by the combustion of one pound of coal is equivalent to the mechanical force capable of raising 9,584,206 pounds to the height of one foot, or to about ten times the duty of the best Cornish engines. Joule gives as the results of his experiments the mechanical force of the current produced in a Daniells battery as equal to 1,106,160 pounds raised one foot high per pound of zinc, and that produced in a Grove battery as equal to 1,843,600 pounds raised one foot high per pound of zinc. This is infinitely above what can be practically obtained. Upon the whole, we feel ourselves justified in fixing the maximum available duty of an electro-magnetic engine worked by a Daniells battery at 80 pounds, raised a foot high for each grain of zinc consumed. This is about one half of the theoretical maximum duty. In the Cornish engines, doing the best duty, one grain of coal raised 143 pounds one foot high. The price of zinc is £35 per ton, and that of coal £1 per ton. By improving the battery arrangements, operators may eventually succeed in getting a greater available electric force. But it must not be forgotten that the development of any physical force observes a constant law. Whether in burning coal in the furnace, or zinc or iron in the battery, the chemical equivalent represents the theoretical power. Zinc burns at an elevated temperature; in burning a pound of zinc there should be obtained as heat the same amount of chemical power which is obtained as electricity in the battery. The heat being more easily applied as a prime mover, it would be far more economical to burn zinc under a boiler, and to use it for generating steam power, than to consume zinc in a voltaic battery for generating electro-magnetic power."

The phraseology is not one which we should accept with our present knowledge and modern definitions, but the figures given serve the purpose of the quotation.—*London Electrical Review.*

* * There is a pool in Utah only a foot deep, and situated at a very high altitude, that refuses to freeze even in the severest winters. There is another that mysteriously replenishes itself with half-grown trout. One stream, though clear as crystal to the eye, and tasteless, stains all the vegetation it flows over a deep brown. A warm spring near Salt Lake City is the strongest sulphur water in the world. A hot spring, a few miles off, with waters so hot that you can hardly put your hand into them, and as bright as diamonds, is one of the most remarkable combinations of chemicals ever analyzed.

* * The improved kind of explosive recently brought to notice in foreign journals, and known as cocoa powder, is said to possess such superior value for many purposes that it has been introduced in the famous Krupp factory. It is asserted that, with equal pressure, this substance gives greater velocity to a ball than can be obtained with ordinary powder, while its smoke is found to be less dense and to clear off more quickly. It is brown, or, rather, chocolate colored. In sundry tests about one-seventh less of it was required than of the ordinary kind of powder to produce given results. The merit which is especially advanced in its favor is, briefly, that of beginning its combustion moderately and steadily, and then, when the projectile has started through the bore, burning with great rapidity, and with, of course, tremendous impelling force. The method of preparation and the cost as compared with other explosives are not stated.

* * Percy Smith, writing on the liability of trees to be struck by lightning, says: "The suggestion that oak trees are struck because they contain iron is both erroneous and absurd. If the oak did contain iron it would in all probability increase its conducting power and act as a preventive. If oak contained an estimable quantity of that metal the wood would turn black on exposure to air on account of the tannin which is present. The blackening may be seen surrounding the iron nails in any oak fence. The contour of the ground, nature of the soil, and the presence or absence of water have more influence in deciding the locality of an electric discharge than the height of a tree. Add to this the difference in conductibility between various woods, and we have at once an explanation of the apparent peculiarity of tall trees escaping unharmed while shorter trees are destroyed."

* * Prof. Luigi Cerebotani, of the University of Verona, has invented an ingenious instrument for ascertaining the distances of accessible and inaccessible points. The apparatus consists mainly of a pair of telescopes mounted on a stand and fixed on a tripod for use. These telescopes are both brought to bear on the object, and a reading is then taken from a graduated scale on the instrument, which, compared with a set of printed tables, gives the distance. By this means the inventor obviates the necessity for the base line, which has hitherto had to be laid down, and he dispenses with all trigonometrical calculations. Distances can be measured between far-off objects, and by the use of a sheet of paper on a drawing board a rough plan of the country under measurement can be sketched In the same way the distances of ships at sea or of moving objects on land can be determined. The apparatus appears to be well adapted for land surveying and particularly for military purposes.

Electrical Review.

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NEW YORK, NOVEMBER 28, 1885.

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It is curious to read the opinions of some of the New York daily journals on the underground wire question. The intellectual department of the *Herald* woke up one bright morning last week and discovered that the time given by the Legislature for the burial of the wires was up, and much to their surprise the emissaries they sent around the city discovered that the wires were up also. The *Times*, which always takes matters of this nature so much to heart, takes the Subway Commission to task in its own delicate and inimitable way. It calls them politicians and other things, and intimates with its peculiar refinement of expression that they have been moved by sordid influences. Corporation Counsel Lacombe writes to the Mayor to say that he doesn't believe the Legislature intended to give the Subway Commission as much latitude as they are taking, which seems to be a singular statement, coming as it does from one who ought to be learned in the law, especially when further along he expressly admits that he cannot construe this law, and that therefore "a further discussion of the question by the Law Department would seem to be unnecessary." He says the question will have to be settled by the courts and perhaps in this instance he will turn out to be right.

The Electrical Subway Commission, of New York, investigated the Dorsett conduit system at Chicago, on Monday last. They were shown seven miles of conduit in good working order, after which they visited the works of the conduit company and witnessed the process of manufacture. They seemed to be deeply interested and pleased with the excellent results obtained. City Electrician John P. Barrett and his able assistant, Mr. C. C. Haskins, received the Subway Commission and explained the successful workings of the system originated by Mr. Barrett, in which the fire and police department wires, also the electric light and telephone wires were working admirably through the Dorsett conduit to all parts of the city. Mr. Thompson, of New York, electrical engineer with the Subway Commission, talked through three miles of the Dorsett conduit, and over twenty-three miles of overhead wire during a hard storm, and pronounced the service very satisfactory. Several tests were made on long and short circuits, and the results were all favorable. Detroit and other places are now being visited by the Commission.

LIGHTING THE NEW YORK WHARVES.

Those who visit New York City should not fail to visit the river front. All along the North and East rivers and the battery will be found voltaic arc lights, strung in a continuous chain, and which illumine the wharf line as it never was illuminated before. Few outside of New York know how obscure and dangerous were the purlieus of West and South streets after nightfall in the times now happily gone by. One saw here and there a dim, flickering light, rendered still more ineffectual by the blowing of the river and sea breezes. Unless the moon was unobscured, he saw only a dim outline of wharves and ships, with here and there a timid gaslight struggling through the darkness from out a dead light or cabin window. As a consequence these places were a veritable paradise to the thieves, thugs and water rats, who laughed at the police and night-watchmen, and had little trouble in escaping their vigilance in the inky darkness that beclouded their haunts. Having weak eyes that cannot stand a strong light, like that of the sun, these marauders always kept under cover during the day, emerging only when the gas companies lighted their farthing dips. The newspapers teemed with assaults and robberies, and even murders, along the river front, and those who were so unfortunate as to be compelled to enter the wharf district after nightfall, took their lives in their hands. No honest man was safe, for the bravest man is at the mercy of the most cowardly ruffian who lurks in the darkness. So bold were the river thieves in the old days, that it was no uncommon thing for them to gag the man on watch on a vessel's deck, dismantle her of her running rigging, and even strip the copper off parts of her hull above the water line.

But now, thanks to the electric light, all this is changed. A brilliantly bright light overspreads the water front and the shipping. A man has but to skulk about the wharves and he is seen; a policeman walking along West or South Streets can see moving forms many blocks away, and the lookout on the deck of a ship can make out and prepare to receive a hostile boat's crew long before it is close aboard. No streets in New York are now better lighted than these, and it is perhaps not too much to say that nowhere is life and property safer. The electric light has proved too strong for the weak eyes of the "water-rat," and the burglar burgles no more, or if he is yet at the business, he has found other and more congenial haunts where the "mellow glow" and bad smell of the gas company's product makes things comfortable for the burglar as well as for the burglaree—if such a term may be applied to a citizen whose house is being quietly robbed. But to do any "cracking" under the full glow of an electric arc light is dangerous as well as an uncongenial business, even to a river-thief, who is somewhat fastidious as to his surroundings. In trutl., he might as well notify the police department of his intentions, and be done with it.

Here we have another achievement of the electric light.

THE RECENT DYNAMO TESTS AT PHILADELPHIA.

Editors Electrical Review:

There seems to have been some confusion in the mind of the writer of the article on "The Recent Tests of Dynamos at Philadelphia," published in your issue of November 14, 1885, in regard to the relative commercial efficiencies of the Edison and Weston machines.

He states that "when we come to consider the point of commercial efficiencies we find the Edison machines leading their rivals by a small amount."

Now, that statement is not correct, and if the writer of the article will carefully study the official report he will find nothing there to warrant it. As a matter of fact, all the tests prove just the contrary.

By examining the table of total and commercial efficiencies on page 8, it will be found that the efficiency of the large machines of each type is slightly higher than that of the smaller ones of the same type. That is to say, the efficiency increases slightly as the capacity of conversion increases. For example the capacity of conversion of the Edison No. 4 machine is 10,000 watts. The average total efficiency of this machine is 90 31, and its average commercial efficiency, 83.97. The capacity of conversion of the Edison No. 10 machine is 25,000 watts, its average total efficiency 90.25 and its average commercial efficiency 85.37, a difference of nearly 1.5 per cent. in favor of the larger machine. Comparing any of my machines we find the same rule holds good. For example the 6M. machine has a capacity of conversion of 9,600 watts, an average total efficiency of 93 84, and an average commercial efficiency of 87.26. The 6W.I. machine has a capacity of conversion of 13,000 watts, an average total efficiency of 93.70, and an average commercial efficiency of 87.86.

These facts are very clearly shown in the annexed table:

TABLE OF EFFICIENCIES.

		Commercial Efficiencies.					Total Efficiencies.							Weight.	Capacity in Watts.	Amperes.	Volts.
		Full Load.	¾ Load.	½ Load.	¼ Load.	Average.	Full Load.	¾ Load.	½ Load.	¼ Load.	Average.	Average Commercial Efficiencies.	Average Total Efficiencies				
Edison, No.	4	88.44	87.40	83.65	76.40	83.97	94.45	93.26	89.65	83.89	90 31	87.96	90.31	1470	10,000	80	125
"	5*	89.19	88.23	83.61	77.53	85.37	96.01	94.44	90.55	83.32	90.25	88.46	90.25	2475	12,500	100	125
"	10	89.96†	88.93	83.12	77.53	85.37	94.68	92.44	90.55	83.32	90.25	88.46	90.25	4710	25,000	200	125
"	20*	91.96†	91.19	88.93	83.76	88.94	96.65†	95.46	92.77	88.80	93.42	.....	†98.49	8331	50,000	400	125
Weston,	6M	87.66	90.10	89 23	82 87	87.26	94.07	93.38	94.84	89.33	93.84	87.96	93.84	2000	9,600	80	120
"	7M	89 37	90.49	89.57	84.37	88.45	96.56	96.38	94.84	90.08	94.46	87.86	93.70	3800	20,000	195	160
"	6WI	90.85	89.22	87.82	84.07	87.86	96.20	94.06	92.89	91.64	93.70	88.45	94.46	2100	13,000	100	130

*Armature insulation gave way. †Unofficial.

From this it follows that it is unfair to compare two machines of widely different capacities of conversion.

Assuming such a comparison fair, however, what is the relative position of the two machines?

An inspection of the table proves beyond a doubt that the Weston machines of equal or *even less* capacity are more efficient than the Edison machines.

There is no better proof of this than is afforded by a comparison of my 6 WI machine, which has a capacity of conversion of 13,000 watts, with the Edison No. 10, which has a capacity of conversion of 25,000 watts. The Edison No. 10 machine had nearly double the capacity of my 6 WI machine, and yet mine considerably exceeded it in efficiency, as the table clearly shows. In regard to the test of the Edison No. 20 machine, I would state that had I known that the committee intended to publish the results of the tests of this machine, *which were not conducted in accordance with the provisions of the code*, I should have insisted upon their testing one of my machines of nearly equal capacity.

The committee seem to have gotten over the difficulty in the matter of the code in this case, by marking the test "Unofficial," but they have nevertheless given this unofficial test the authority of their endorsement in the following words:

"In the table the full-load efficiencies of the Edison No. 20 dynamo are marked 'unofficial,' because the preliminary run was not in conformity with the code, *not because there is any reason to mistrust the results.*"

I leave it to them, therefore, to explain the difference between this "unofficial" test with an "official" endorsement of its correctness, and any of the other, specifically official, tests. It seems to me there is here a distinction without a difference. Is it not equivalent to saying that this is an *official* unofficial test? I think so.

But taking this No. 20 Edison machine, which had a capacity of 50,000 watts, the tests of which were unofficially (?) injected into the series, how does it stand when compared with my 7 M machine, which has a capacity of only two-fifths that of the Edison machine? It had the advantage of it *by less than one-half of one per cent.*

The respective positions of the machines tested are as follows:

	No. of Machine.	Weight.	Capacity in Watts.	Average Total Efficiencies	Average Commercial Efficiencies.	Average Total Efficiencies	Capacity in Watts.	Weight.	No. of Machine
	6 M	2,000	9,600	93.84	87.96	90.31	10,000	1,470	4
	6 WI	2,100	13,000	93.70	87.86	.....	12,500	2,475	*5
	7 M	3,800	20,000	94.46	88.45	90.25	25,000	4,710	10
	.....	.....	.....	.....	.....	†98.49	50,000	8,331	*20
	Weston.						Edison.		

* Armature insulation gave way.
† Unofficial.

A few words in regard to the proper way of arriving at the true commercial efficiency of the machines.

The writer of the article seems to think that the efficiency under full load gives the true commercial efficiency. That cannot be, because machines in practical use are gener-

ally run with widely varying loads. The competitors realized this fact, and they were both anxious that the tests should be conducted under conditions as nearly identical with the conditions of practical use as it was possible to get without too much labor.

For this purpose they agreed that four tests for the efficiency of each machine should be made, viz.: one with full load, one with three-quarter load; one with half load, and one with quarter load.

The first of these tests was to continue for at least five hours after the machine had reached a maximum constant temperature. The remaining three tests were to be made as soon as the machine had reached a maximum constant temperature under the given load.

See clauses 9, 10, 11 and 13 of Section 4 of the Code.

Now is it likely that the competitors or the committee would have spent their time in making such a series of graded tests if the true commercial efficiency could have been determined by a single test under full load? Most assuredly not.

The true commercial efficiency is no doubt much nearer the average of the four tests than the efficiency of the machine as shown by full load tests, consequently comparison of efficiency of the machines ought to be made upon the first-named basis.

EDWARD WESTON.

Newark, N. J., November, 1885.

GENERAL WESTERN NEWS.

The Milwaukee muddle, like a novel in a magazine, is continued from week to week. On the 14th instant the *Sentinel*, which is forninst electric lights, published the statement that the Badger Electric Light Company had sold out to the American Electric Manufacturing Company, and quotes the REVIEW to prove its position. The comments of the *Sentinel* are anything but complimentary to either the president of the Council or the president of the Electric Light Company.

It was rumored and believed by many that certain capitalists in Chicago were behind the Badger company, and one or more of these were telegraphed to from Milwaukee, and their denial of the statement published in the *Sentinel* brought the capon-lined councilman to the front with an explanation. In an interview President Hinsey said "There has been nothing done which can compromise the city. I shall offer an amendment to the ordinance compelling Badger to furnish the Thomson-Houston lights. If he does not agree to this he cannot have the franchise by my vote. In the course of time, as improvements are made, we will order that the additional lights be of the improved kind. A year from now the Sperry light may be better than the T. H.; at present it is the poorest in Chicago.

"Now about these disclosures. I have never said George M. Pullman was interested or about to take an interest in the Badger Company. What I did say was that men like Fairbanks, Morse & Co., George M. Pulman and other Chicago capitalists, were vouching for the ability of Badger to secure all the capital he might need to put in the Milwaukee plant. I don't understand why the manager of the Thomson-Houston Company should make the statement which is attributed to him. He knows perfectly well that Badger is using the Thomson-Houston lights in Racine, Joliet, Keokuk and Chicago, and that he has paid for them. He will undoubtedly furnish Badger with lights for Milwaukee because Badger will pay for them, and as we won't have any other kind for the present, that is all there is of that business.

"Respecting Badger's deal with the American company, it is perfectly fair and legitimate. He has not got the money to put in the Milwaukee plant, and he goes to New York to procure the capital needed. A letter to me from President Goff explains the position. That company is not an electric light company. They have no light of their own, unless it be the Fuller, and he will not allow the Fuller light to be used. President Goff said the company would furnish all the money needed by Badger after first giving local capitalists an opportunity to subscribe for stock."

He explains that Badger had merely turned over his interests in the several plants named above to raise money for his new enterprise.

After again stating in effect that with him it's Thomson-Houston and Badger if possible, or Thomson-Houston or nothing, the president said that Badger already had enough of those lights, and it doesn't matter what the T. H. company say or do in the matter, so far as Milwaukee is concerned.

"Now," said the President, "you might as well make up your minds to the fact that we are going to have electric light in Milwaukee, and that within a short time. The merchants want it. * * * Electric light is a vast improvement over gas. There was the same difficulty when gas was first introduced. * * * The Sperry light simply means a perpetuation of the gas monopoly. We will have the best light that can be had. At present the Thomson-Houston lights are undeniably the best. As I said before, it is no sell out for Badger to make that contract with the American. His plants at Racine, Joliet, Keokuk and Chicago are worth $400,000 and constitute the security for the loan which Badger asks of the company."

All this preliminary skirmishing brings the record up to the morning of the 16th. That evening the council met, and with but little opposition in a direct line, the ordinance, somewhat amended, was ordered engrossed.

Alderman Warden fired the first gun. He moved a postponement of one week inasmuch as the ordinance seemed, from the number of amendments, to be very imperfect, and furthermore, that it had been charged that Badger had bartered the franchise in the marts of New York, and the matter should be thoroughly investigated.

The president vacated the chair to oppose the postponement.

Alderman Dunck said that Badger had not bartered away the franchise, because none had been granted.

A vote of 13 ayes to 20 noes refused to postpone the question, and a similar vote refused to re-refer to the Judiciary Committee.

The amendments were then taken up and a rattling fire of small arms on general principle was heard all along the line.

It was announced that the general manager of the Thomson-Houston company was present, and had said that Badger would not be permitted to use their lights.

President Hinsey said this was all a trick—an attempt to steal the franchise from Badger, simply because the council wants their lights and won't take any other. There was an ordinance forthcoming which proposes to give the Thomson-Houston Company a franchise. This would be exchanging a gas monopoly for an electric light monopoly, and he was opposed to it. As between the two, the gas monopoly was preferable, because it was made up of Milwaukee citizens and taxpayers.

Finally, amendments were adopted, one requiring Badger to supply "The Thomson-Houston improved system of arc and incandescent lighting, or such other system of electric light as the Common Council may decide to adopt," and another which provides that the city may at any time purchase the entire outfit, the price to be determined by arbitration, and one or two others of only local importance. The balance of the amendments were bunched and tumbled into the waste basket, when by a vote of 25 to 9 the amended ordinance was ordered to a third reading.

The Dorsett conduit ordinance was also taken up. A communication was read from Mr. Benezetti Williams, of Chicago, stating that his conduit was better than Dorsett's, and asking to be heard before any exclusive rights were granted.

The aldermen seemed to take but little stock in Mr. Williams, and his communication was placed on a skewer, pigeon-holed, or something, and the Dorsett ordinance, without debate and without a formal vote (all the aldermen seeming to be agreed on the desirability of having a conduit which is becoming so justly popular), went to its third reading.

On Tuesday night a demonstration was made at the retort house of the gas works in Milwaukee which should have been suppressed by the police and the offenders severely punished.

The President of the Council, in his endeavors to secure electric lights for the city and people, has incurred the enmity of the employes of the gas company, and these, undoubtedly encouraged by those who should have deterred them from, rather than have allowed them to carry out their designs, disgraced themselves and smirched the fair fame of the city by hanging, waking and burning the President of the City Council in effigy. There is a smack of the red flag, communistic, divide - every - Saturday - night-as-long-as-you-have-more-than-I-have argument in this sort of thing, which can but make any respectable advocate of free institutions blush with shame. The individuals who would encourage or inaugurate an exhibit of that disgraceful nature are of the class who have come to America to enjoy her free institutions, and undersell their labor in competition with those to the manor-born, and yet they raised the hue and cry that the "Boss," as they term President Hinsey, was endeavoring to take from them their bread and butter. The fact in this matter is that for every gas light lost by the introduction of electric lights everywhere, more than one is gained to the gas producers.

And the electric light companies in Chicago are not just now supremely happy, because of the phase the sidewalk-area question has taken.

As previously stated, the real-estate men have become alarmed at the action of the council in proposing to amend the charter of the underground company so that wires may be distributed more readily in each block, by running a branch from the street main into the sidewalk area, and thence round the square for all forms of electrical purposes.

To put it in the form one of our daily papers has it, under the date of the 19th:

A meeting of property owners to protest against the outrageous conduct of the City Council in its efforts to deprive them of certain vested rights in the use of the sidewalks abutting on their holdings in favor of a single money-making corporation was held in the rooms of the Real Estate Exchange at No. 159 La Salle street, yesterday afternoon.

At a previous meeting a committee on resolutions had been appointed, and Mr. E. A. Cummings reported the following, which were unanimously adopted:

Whereas, There is now pending before the Common Council of the City of Chicago amendments to the ordinance giving certain private persons and their successors and assigns, the right to use the space underneath the sidewalks throughout the city, subject only to such restrictions as may be made by the Commmissioner of Public Works; and

Whereas, Such space has been, since the construction of permanent buildings, and is now used by the abutting property-owners with the consent of the city, and large expenditures have been made by said property owner to improve said space and to keep same, the sidewalk above, and the street adjoining in repair; and

Whereas, The passage of such ordinance may eventually result in ejecting the abutting owners from said sidewalk space, causing the loss to them of immense sums of money which they have expended on the faith of the city, under permits granted by the Building Department of said city, and

Whereas, Equity and justice demand that if said sidewalk space is to be granted to any persons or corporations for money-making purposes that right should be granted to the abutting property-owners who have created and maintained the space, as has been the custom as long as Chicago has been a city, rather than make a gift of it to private individuals or corporations who have contributed nothing towards the creation and maintenance of said sidewalk and the space under the same; be it

Resolved, By the property owners assembled, that we do most respectfully protest against the passage of the proposed amendments, and that a committee of five be appointed to wait upon the Committee on Fire and Water to whom the matter has been referred by the Common Council, and respectfully present the views of this meeting and ask that such ordinance as amended do not pass.

Several gentlemen who spoke on the general issue, seemed to be impressed with the idea that an inch given would be an ell taken by the company, and that the ordinance, once passed would require the present occupants of the areas to move out, bag and baggage, to make room for some huge electrical anaconda that was seeking to strangle the business lives out of them. One gentleman saw in the near future a canceling of all his insurance policies by the companies, and a renewal only at exorbitant rates. Then by and by as the fierce amphibian increased in strength and obesity, the entire space would be required to accommodate his leviathan proportions.

Another gentleman saw that in the future the holes in partition walls would rapidly increase in size, and the owners of property abutting would have enormous repair accounts to settle with the city.

After "more of terrible and awful, which e'en to name would be unlawful," Mr. F. W. Cushing, superintendent of the underground company was permitted to present the company's side of the case, as reported by the journal above quoted from:

Mr. Cushing said during the last summer the conduit company had laid seven miles of conduits through the principal street [and found the same burdensomely expensive, no doubt, owing to the amount of digging and repaving that had to be done.—ED.], and now the idea was simply to get the use of the space under the pavements for the wires which were to terminate in each particular block. They would have but one place of connecting with the main conduits, and at that point they would have a man-hole with arrangements for connecting. The original ordinance drawn by Mr. Winston, the Corporation Counsel, gave large privileges, more than they wanted. The amendment had fixed the amount of space for their pipes at twelve inches diameter. Six inches would be plenty.

Mr. Coe inquired why they did not run the wires around the outside of the curb-wall.

Mr. Cushing said it was not a very good plan, but that it was feasible.

The Chairman, Mr. Baird, said he had failed to catch Mr. Cushing's statement of the reasons why the wires could not be laid outside of the curb-wall of each block, and he begged him to repeat it.

The chairman remarked that they could all see that there was a possibility of a tremendous outrage, no matter what the direct object of the company might be, and it would be necessary to oppose the scheme vigorously. In accordance with the resolutions he appointed a committee of five to go before the Council Committee Friday afternoon to present the protest of the property-owners.

Seriously, the whole matter is of grand importance, and one which will bear the strictest investigation. While it is necessary that the present rights of property-owners and occupants should not be ignored or invaded, the necessities of the underground people, if properly restricted, may be accommodated with very little inconvenience to those who are so fierce in attacking the proposition. There is little cause for alarm in the fact that the employes of the underground company will have to occasionally visit the premises. This is done at stated periods by the gas and water employes, and the plumber fraternity more often does damage to property than electrical workmen. The telephone man, known by his badge, is permitted access to portions of private residences where the underground man would never dream of asking admission, so that take it all in all, the probability is that this is one of those sort of things "that's nothing when you get used to it."

Col. S. G. Lynch, at 144 La Salle, furnishes the following quotations of telephone stock values:

Chicago	$375 @ $400
Central Union	50 @ 53
Michigan	64 @ 67
Iowa Union	18 @ 20
Great Southern	30 @ 32
Colorado	13 @ 15
Rocky Mountain Bell	40 @ 45
Mo. & Kas.	54 @ 57
United	14 @ 15
Cumberland	70 @ 75
Wisconsin	110 @ 112

CHICAGO, Nov. 26, 1885.

Telephonic News

⁂ Seems as if Hallowell, Me., ought to be a good town for the telephone.—*Boston Commercial Bulletin.*

⁂ The work of laying the conduits in Brooklyn has commenced, and the smell of gas can be noticed a block away. The earth is strongly impregnated with it.

⁂ Western Pennsylvania farmers are trying to prevent the Philadelphia Natural Gas Company from laying a twenty-inch main through their farms.

⁂ The pioneer in the telephone field in Chicago was F. W. Kinsman, now of New York, who put in a plant for the Western Union company, using the Edison instruments.

⁂ "Hello," shouted the man at the New York end of the telephone line, "give me Boston." "Wait a minute," replied the operator at the Hub, "I want to ask the Mayor if the Aldermen are through with it." —*Tid-Bits.*

⁂ The telephone has been introduced into many of the hotels and cafés of Belgium, and guests are allowed to make use of it without charge. Under the circumstances the user makes a point of ordering some refreshment, so that the proprietor gets his money back.

⁂ At Leavenworth, Kan., there is considerable talk of moving the telephone exchange farther up town. If this is done two new multiple boards will be put in, which will greatly expedite the service. The multiple boards if the exchange does not move, will be put in in the spring.

⁂ Frank Osborne, aged 28, manager of the telephone exchange, at Ithaca, N. Y., disappeared last Saturday. Investigations since made show that $250 collected by Osborne is unaccounted for. A warrant has been issued for Osborne's arrest for grand larceny. His ruin is said to be due to his intemperate habits.

⁂ The people of Leavenworth, Kan., a city of 25,000 inhabitants, are congratulating themselves over a new telephone line to Kansas City, Mo. The present line is in constant use, and the new one, which is constructed over another route, some thirty miles in length, will divide the burden and increase the value of the service proportionately.

⁂ The many Rio friends of Mr. Frank W. Jones, formerly superintendent of the telephone company here, will be interested to hear of his marriage (to Miss Jeannie Humphrey, of Buffalo, N. Y.), which took place in that city on the 24th ult. The congratulations and good wishes of the *News*, and a host of others, are cordially offered the happy couple.—*Rio Janeiro News.*

⁂ Judge Fisher granted an injunction in Baltimore upon a bill filed in the Circuit Court by Charles J. M. Gwinn, counsel for the Chesapeake and Potomac Telephone Company, to restrain Mary F. Farnandis and Richard H. Mitchell from removing one of the company's telephone poles in front of 73 Cathedral street. The house is owned by Mrs. Farnandis and occupied by Mr. Mitchell and both objected to the pole, which led the company to fear that it would be interfered with.

⁂ A correspondent of the REVIEW who recently visited Louisville, Ky., writes in glowing terms of the telephone exchange in that city. The office is what might be called a perfect telephone office. The building was constructed especially for the telephone company, and is of brick, and fireproof throughout. There are fifteen day operators, and nine at night, seven being relieved at 10 P.M. There are three exchanges in connection with the Louisville exchange (not counting numerous toll and public stations), comprising some 1,400 subscribers, nearly 1,300 of which are in Louisville proper. The wires come into the main exchange through two underground cables, 625 feet long, and four overhead cables each 225 feet long.

⁂ In Vienna they recently exhibited gas and water service pipes made of paper. The same kind of pipes will do for many factory purposes, for laying electrical wires, etc. The pipes are made as follows: Strips of paper are taken, the width of which corresponds with the length of one pipe section. The paper is drawn through melted asphalt, and wound upon a mandril which determines the inner diameter of the pipe. When the pipe thus made has cooled, it is pulled off the mandril and the inside is covered with a kind of enamel, whose nature is kept secret by the makers. The outside is painted with asphalt varnish, and dusted over with sand It is stated that such a pipe will resist some 2,000 pounds internal pressure, though the thickness of the stuff is only about half an inch.—*Paper World.*

⁂ The American Bell Telephone Company and the Great Southern Telephone and Telegraph Company, through Messrs. Bayne & Denegre, have filed at the United States circuit court, at New Orleans, a lengthy bill in equity against the National Improved Telephone Company, the Crescent City Telephone Company and W. Vanbenthuysen, John R. Juden, Marcellin Gillis, H. O. Seixas, J. H. Menge, A. G. Olier, Edgar Van Ben Thuysen, U. Marinoni, Louis Bush, S. M. Todd, B. Laplace, C. E. Black, T. L. Airey, A. Brittin, George Moorman, Newton Buckner, R. M. Walmsley, Charles Newman, J. C. Denis, Pierre Lanaux, N. D. Wallace, S. H. Buck, I. L. Lyons, A. A. Maginnis, Charles P. Huntington, W. W. Gibbs and C. L. Magee. The bill is sworn to by W. H. Forbes, president of the American Bell Telephone Company, and J. J. Fowler, general manager of the Great Southern Telephone and Telegraph Company.

⁂ A very simple, though somewhat expensive, arrangement of telephone wires has been introduced in a Glasgow merchant's office, by which, it is stated, the annoyances of induction are prevented. The office is connected with the proprietor's dwelling house, some thirty miles distant, by a private line. To prevent disturbances from the induction of other wires, he employs a return wire, and the wires are simply arranged in a spiral or helical form, as follows: Suppose each post to be provided with four insulators, arranged at the four angles of a square, the sending wire is attached to insulator 1 on the first, 2 on the second, 3 on the third, 4 on the fourth, 1 on the fifth, and so on. The return wire is attached to the insulators at the opposite corner of the square, or what would correspond to that position, thus forming the helix.

⁂ At a recent meeting of the fire and lighting committee, New Orleans, the following business was transacted: The bid of the Southern Telephone Company to erect the fire alarm lines for $887 was talked up. Commissioner Mealey and Superintendent Kennedy appeared before the committee and said that the entire police and fire alarm lines should be rebuilt, and that by doing so at once, the city would save the cost in less than a year. The clerk was instructed to draw up a motion, authorizing the Comptroller to advertise for bids to erect the two systems. The Commissioner of Public Buildings submitted a list of the buildings now lighted by gas, and the Comptroller will, by motion, be authorized to advertise for bids for lighting same by electricity or gas. Mr. Farrell's motion, that the Louisiana Electric Light Company pay their pole tax by supplying lights, Mr. Simon, vice-president of the Louisiana Company, agreed to the proposition, and estimated the number of lights thus to be had at twenty-three. The gas company submitted a proposition to light 170 lamps in the markets at $42 a lamp per annum, 11-candle power. It also offered to light the public building with twenty-candle lights at one cent per hour, but impressed upon the committee that it would not touch the contract unless the City Council appropriated $1?,000 for this purpose as a guarantee that the bills would be paid. The committee did not propose to have the gas company dictate to it, and therefore decided to advertise for bids for lighting the markets with arc lights and the buildings with incandescent lights.

⁂ From the Baltimore *Sun:* "It is said on the authority of Mr. Wilbur, who was the examiner in the Electrical Division of the Patent Office when the Bell applications were submitted, that at that time the proposed telephone was looked upon more as an electrical toy than anything else, and no thought was suggested that it was a great mechanical invention destined to become of such immense value. Bell's own attorneys, he said, did not have any large expectations of its practical utility. Mr. Wilbur said Bell's application was filed about three hours before that of Gray, on the same day. He held that two applications filed on the same day were cotemporaneous and the matter should be determined by interference proceedings, but the then Commissioner of Patents, General Spear, overruled him and decided that Bell's application should have priority."

⁂ At Dallas, Texas, recently there was a meeting of the managers of the various Erie Telephone exchanges in the State. The meeting was held in the office of the Dallas exchange and its object was merely to bring the managers together and facilitate and improve, if possible, by suggestions from those present, the quick dispatch of business and the general utility of the system. Besides the general treasurer of the Erie Company, Mr. C. J. Glidden, of Lowell, Massachusetts, the following officials of the company, in Texas, were present: J. K. Dunbar, General Superintendent, Austin; E. K. Baker, superintendent first district, Dallas; J. C. Hill, manager, Denison; H. C. Holcombe, manager, Sherman; I. J. Harrison, manager, Gainesville; J. F. McMurray, manager, Paris; W. B. Eliott, manager, Fort Worth; J. M. Clower, manager, Cleburne and Alvorado; Boyd Anderson, manager, Waco; W. K. Vance, manager, Waxahachie; H. Ballenger, manager, Decatur; C. A. Read, manager, Dallas. This company is now operating 3,000 miles of wire in this State. There are 40 exchanges and 165 stations. There are now over 4,000 exchange subscribers.

⁂ The "time by telephone" is proving a great feature at Cincinnati. Some people, however, do not seem to thoroughly understand it, and for their benefit a further explanation is necessary. Taking your telephone from the holder and putting it to your ear you can hear a "buzz." That is the signal to listen. Then comes a series of successive knocks, resembling nothing so much as a fire alarm signal, of which a fair example would be: — — (2), — — — (3), — — — — — (5). The significance of this signal would be that the chronometer indicated 2.35, or thirty-five minutes past 2. The universal adoption of the repeater may lead to consequences of far more importance than appear on the surface. With a telephone in his room a man may arise in the dead of night, go in the dark to the receiver, and know the exact hour, minute and second of his untimely waking. Or, better still, a lazy man needs only to hang a telephone at his bedside; then, if he awakens in the morning with that nameless prescience which comes to all at times, of having awakened an hour before his time, he has only to hold the instrument for a moment to his ear, to corroborate his first impression, and sink back into the luxurious enjoyment of an early-morning nap. Any one who has fished aimlessly under a pillow, on a cold winter morning, for a $4.50 watch and found, when at last its dirty face came to view, that the watch had stopped, will appreciate the value of the new arrangement. Jewelers complain that the new device has set their patrons to counting the seconds and made them captious and exacting. A man whose telephone is connected with the repeater rushes in to his jeweler in angry haste, and declares: "Here, this won't do! Last week I lost two seconds and a half and this week I've gained a second already. I thought you said this watch kept good time?"

⁂ The telegraphic code published by Mr. Labouchere shows the member for Northampton only half awake. By making use of the abbreviations he suggests you can certainly get a good deal into a 6-penny telegram. Thus: "Jones, agony antidote borage archangel," if sent by a husband in the city to his wife, means, "Our old friend Jones is coming out with me to dinner. As he is a bit of an epicure, do your best in the time, and let us have a good glass of wine. He will probably stay the night." All this in five words is perhaps very creditable, but the wife's answer would improve on it. In one word not included in Mr. Labouchere's list she would send her husband the following message: "What on earth made you invite the man to-day? For goodness' sake don't bring him here. Chops only. You know there is no decent wine in the house. Mother has the spare bedroom to-night." Then, without reference to Mr. Labouchere's code, the husband would see things clearly and take Jones round to his club.—*St. James' Gazette.*

⁂ Telpherage is the name given in London to a system of automatically transporting goods by the agency of electricity as the motive power, which system was the invention of the late Professor Fleeming Jenkin. Dying in June last, however, the Professor did not live to see his ingenious ideas carried out on a practical scale. But it has been done since by Professor Perry, and a line successfully opened and operated by electricity. The line is a double one nearly a mile in length, and is composed of two sets of steel rods, three quarters of an inch in diameter, supported on wooden posts of T shape, and about eighteen feet high. The wires are supported one on either end of the cross piece of the T, which is eight feet long. The carriers or skips, as they are technically termed, are iron trough-shaped buckets, each holding about two hundredweight, and suspended from the line by a light iron frame, at the upper end of which is a pair of grooved wheels running on the line of rods. A train is made up of ten of these skips, which are in electrical connection with each other, and with an electrical motor, which is placed in the middle of the train, having five skips in front and five behind it. At a point about midway of the length of the line is the engine house, in which there is a steam-engine which drives the dynamos. From these latter the current is led to the line, and thus to the electrical motor which moves the train.

⁂ An esteemed telephone friend of the REVIEW sends in the following: "After several years of dread and uncertainty, a highly respected citizen of Buffalo has at last struck it. His researches have taught him that the telephone swears. Man's extremity is always somebody else's opportunity—at least in Buffalo—and this good man sat down to think it all out. He realized that a great deal of cash is expended yearly to spread the gospel, but careful investigation failed to establish the fact that any of it is spread around the noisy end of a telephone. Year after year thousands of loyal American citizens rise up and called the other fellow blessed by telephone, with never a missionary at hand to point out the location of the family Bible. Then the Buffalo evangelist struck it. He whittled out the model of a plan for regenerating poor, profane humanity by telephone. By his plan a Bible will be chained to every instrument. When a fellow succeeds in reaching the ear of the central office, he is expected to take up the religious consolation that has been provided for his accommodation and read for an hour or two. This will give the pretty young missionary who runs the switchboard time to finish her flirtation with the other fellow and get back by degrees to the business walks of life. After a time the man who spends most of his life loafing about the waiting-room of his telephone will be able to turn at once to the chapter which tells how one of the ancients never lost his grip on his temper because they hitched him on to Toledo when he wanted to talk with one of the prophets in Ann Arbor. The world owes Buffalo one for this great discovery in moral science."

Electricity in War.

Under the above heading, the New York *Sun* publishes the article which follows, and we give it space, not only upon its merits, but also to show the interest that the daily press is evincing in all the detail of the new work of electricity:

"The essay of Lieut. B. A. Fiske, of the navy, read before the Franklin Institute, of the part played by electricity in warfare, shows it to be already a military agent of high importance, instead of a power to be developed only in the future.

"Probably few people appreciate the fact that electrical torpedoes really date back over forty years, to the time when Col. Samuel Colt, in the presence of President Tyler, Gen. Scott and many Congressmen, blew up vessels five miles away by the use of an electric wire. Long after, nevertheless, both in European wars and in our own civil conflict, combatants were content to rely chiefly on the old mechanical mine, which, when once fixed in a channel for the defence of a harbor, blows up impartially friend and foe. Hereafter the almost universal rule will be to plant torpedoes that remain harmless until a signal delivered through the electric wire shows that the enemy is upon them, which will be instantly responded to by the return current from the firing battery on shore. The harbor is then no longer blocked to all friendly commerce from the moment that torpedoes are planted. On the other hand, electricity may be employed also to detect the presence of fixed torpedoes. In movable torpedoes it exercises constant control over the weapon, directing it against the enemy, and hence preventing him from evading it, as he may evade non-electrical torpedoes.

"The torpedo, however, though just now the most prominent military application of electricity, is only one of many. The military telegraph was familiar in our civil war, where it had its origin; and now military telegraph corps, with their special apparatus for laying wire at great speed, form a part of all great armies. The telephone supplements the telegraph, and both instruments are used in artillery practice to track hostile vessels so as to determine exactly when to fire on them, and also to register the time of flight of projectiles. Since Lieut. Fiske says that 'the precise instant of start to within a thousandth of a second' is recorded for projectiles by electricity, the suggestion comes up whether some application of electricity will not one day give more accurate indications in racing than stop-watches, whose recorded fifths of a second are sometimes looked on with doubt on narrow questions of breaking records.

"Electricity now fires whole broadsides of prodigious guns with the touch of a button, thereby not only producing that absolutely simultaneous discharge which has hitherto not been known, but also eliminating the element of change in aim produced by even an instant's roll of the ship during the slower process of hand firing. Electricity also can handle with ease heavy ordnance in forts and on shipboard, though this must rather be ranked among its uses hereafter to be developed.

"Electricity examines the bores of guns to ascertain their condition, and in the powerful form of the electro-dynamo search-light unveils in the darkest night secret movements alike on ship and shore, of besiegers and besieged, the stealthy approach of the torpedo boat, or the movement of a hostile column to surprise a fort. As a signal-light it is palpably useful, while it can even be made to confuse an enemy by throwing upon him sudden alternations of blinding light and paralyzing darkness.

"Launches have been driven by electricity, which will, doubtless, on account of the steady improvement of storage batteries, one day wholly replace steam for this purpose. Electric sights for rifled muskets are now furnished for night firing; and combined with them are small lamps for illuminating the target. Rubber bands fasten these ingenious devices to the marksman's gun. There are also electric rifles, in which the soldier presses a small button, thereby, unless he is a very skillful marksman, getting a better aim than when he pulls a trigger.

"If, in addition to all these applications, electricity should furnish a compact and not too heavy power for steering military balloons, its contributions to the art of war will be still more remarkable."

Announcement by the B. & O.

The following announcement has been issued by President Bates of the Baltimore & Ohio Telegraph Company:

NEW YORK, November 16th, 1885.

Mr. W. E. Huntington is hereby appointed General Superintendent of the Baltimore and Ohio District service.

General Superintendents of Divisions will see that such reports as the General Superintendent of the District Service may require shall be forwarded to him.

Estimates and requisitions relating to the District Service of the Company shall be prepared by General Superintendent Huntington after consultation with the respective General Superintendents of Telegraph.

.... The Western Union Wire Works, at St. Louis, were destroyed by fire one night last week. Barbed wire was the product manufactured by the concern.

.... Steel rails continue to be increasingly wanted, and the price is up to $33 per ton at the mills, with makers fully engaged for the next few months. Only last spring any one could help himself to steel rails at $26 per tun.

....Judge Brewer, in the United States Circuit Court, at Omaha, has commenced the hearing of the celebrated Glidden barb-wire case, which is brought into this court from Iowa. It involves a patent right to an immense quantity of wire that has already been manufactured, and a large sum of money is at stake. Some of the most talented members of the bar of Iowa are at Omaha, representing each side of the case.

... Those who have visited a Spanish, Italian, or Portuguese port, will have a vivid remembrance of the extraordinary precautions against possible risk of infection taken by the sanitary "visit." The following, however, gravely recounted by a Milan contemporary, beats anything we have seen or heard of. At the time when the cholera broke out in the departments in the north-east of France, a number of Italian telegraph officials ordered a quarantine of twenty-four hours, with fumigation, to be imposed upon all telegrams coming from the infected districts.

...A dispatch from Little Rock, Ark., says: "The telegraph war between the Arkansas and the Western Union lines was resumed this morning, when Mr. W. U. Simonds, assistant superintendent of the Arkansas line, and his force, about twenty men, began the erection of poles south of this city, on the Iron Mountain road. Road-master Griffin, of the Iron Mountain with a force of twenty-five men, appeared upon the scene and ordered his men to follow up the telegraph line builders and tear down the poles they erected. Good feeling prevailed on both sides, the men punning each other on the difference of wages paid. The Iron Mountain pays $1.10 per day to its construction men, while the laborer of the Arkansas Telegraph company receives $1.50 per day. It will be understood that the opposition of the Iron Mountain is the Western Union Telegraph company in disguise, that corporation using the railroad company as its ally. The telegraph men put in the day digging holes and setting up poles, while the railroad force kept time by tearing down what they had accomplished. Some of the best legal talent of the city say that the Arkansas Telegraph company are making more money now than they will ever make by operating the wires. Their reason is founded upon the fact that if a legislature has the right by an act to condemn private property and grant the right of way to a railroad over farms on account of the benefit the road will be to the public, it also has the right to condemn railroad property for public use, especially when that use will not interfere with the operation of the road."

....Secretary of Legation Holcombe says it is very difficult to telegraph in Chinese. "It has been found to be practically impossible to reduce the language to any such simple system as that which answers our purposes. The language is composed of 4,000 symbols. It has no alphabet, though there are 216 radical symbols which might be called an alphabet. In the common use of the language about 12,000 symbols are employed, and these have been codified for telegraphic use. The words, however, are never telegraphed. Each symbol is made up of four characters, and in the code these are indicated by numerals, so that, for instance, if I wanted to telegraph the word 'horse,' I would send 0. 0. 1. 3., and the translation would be supplied by the receiver from the code-book. The effect of this is that all telegraphing is in cipher, but what we have is the best that has been provided by years of study."

.... To meet the increased telegraph traffic promised by the sixpenny telegrams, the Post-office ran a copper line from London to Newcastle. The wire was of No. 14 gauge, .080 in. in diameter, and weighed 100 lb. per mile. The length from London to Newcastle was 278.08 miles. A corresponding galvanised iron wire was found to have an electro-static capacity about eight per cent. more than the copper one; and the speed of signaling on the copper wire was decidedly superior to that on the iron wire. Thus copper gave 414 words per minute, whereas iron gave 345 words. This gain of speed is not entirely due, however, to the lower capacity of the copper, supposing the resistance of the two wires practically the same. Mr. Preece thinks it is due to a greater electrical susceptibility of copper, as compared with iron. His opinion is borne out by Professor Hughes, who is at present engaged in investigating this phenomenon with the induction balance. Professor Hughes finds that copper is more sensitive, molecularly speaking, to changes in an electric current, than iron is. For example, he finds it im possible to balance a copper against an iron wire of exactly the same resistance in the Wheatstone bridge, until after a definite but very short time which the current takes to attain its maximum in the iron wire. This effect, which is not noticeable with the ordinary galvanometer, is, in his opinion, not entirely due to the electro-static capacities of the wires but to some molecular inertia or peculiarity of their molecular construction.

.... "I never spent a more terrible hour," said a train dispatcher, "in all my experience than once, a couple of years ago, when two trains got on a piece of track, headed toward each other, upon which I could not reach them by wire. There was an extra up the road, and I had telegraphed a train coming down to wait for it to pass at Brownstown. By-and-bye I got a report from the operator at Brownstown, as I always do at every station when any train passes, saying that the regular train I had ordered to wait there had passed. I replied, 'That can't be; I ordered them to wait for the extra.' The reply came back, 'They have gone on.' Then there was no remedy. The extra had passed the last station going up this side of Brownstown, and both, I knew, were whizzing along the same track headed toward each other. Such a sensation I never experienced, and pray that I never may again. There were those two trains rushing on to destruction; I knew it, and was yet powerless to help it! I could only wait and hope and pray that by some means the catastrophe might be averted. I ordered out the wrecking trains and got everything ready, and waited for more than an hour before I heard the result. That hour I shall never forget. Then came the news that the trains had collided, but, owing to good fortune or providential interference, the engineers had seen their danger before meeting, and applied the brakes before the trains struck, and so prevented such serious results as might have otherwise occurred. There was considerable injury, but no lives were lost. The conductor and engineer were discharged, of course. They had forgotten their orders, and once is sufficient. They were removed, never to be allowed to work on the road again."

TELEGRAPHIC

.... It has been decided that the New Zealand Government will undertake to continue the Australasian cable service for five years, provided the charge for press messages did not exceed 3d., and for ordinary messages 6d.

....The Chicago telegraph operators very generously made up a purse for the sufferers by the Galveston fire, the funds to be presented to the ten telegraph operators at that place who were losers by the fire, several of whom have families.

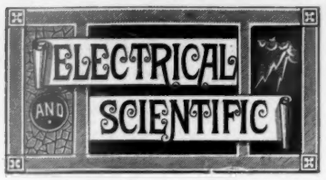
....The *Hotel Gazette*, of Minneapolis, publishes an excellent cut and description of the Hess guest-call and fire-alarm, now in use by the West Hotel, of that city. This new annunciator, which is owned by the Standard Electrical Works, of Cincinnati, is being adopted by a number of the large hotels.

.... The Baltimore and Ohio Telegraph underground wires worked all right on the occasion of the test at Harrisburgh, Pa. The *Telegraph*, of that city, says: "The Baltimore and Ohio Telegraph Company solved the problem. It just put the wires underground and began to work them. That's all there was in it. Next."

....In Norway it is believed that wolves are frightened away by telegraph lines. While a vote was pending on a grant to a new line, a member of the Storthing remarked that, while his constituents had no direct interest in it, they would support the grant, because the wires would drive away the wolves. It is said that, however hungry a wolf may be, he will never go into a spot that is enclosed by ropes stretched on posts. It is stated as a remarkable fact, that since the first telegraphic line was established, twenty years ago, wolves have never appeared in its neighborhood.

.... The Arkansas Telegraph Company began building from Malvern to Little Rock, along the Iron Mountain road, when a construction train carrying fifty men arrived and tore down all the poles and wires, and drove the telegraph men from their work. R. E. Douglass, President of the Arkansas Telegraph Company, set his men to work building from Little Rock to Malvern, when the fifty men again arrived and destroyed the work as fast as it was done. Mr. Douglass was told that he positively could not erect his poles along the right of way of the Iron Mountain Railway, and that 400 men were ready to prevent him doing so. He withdrew his force to prepare to call upon the authorities to protect him. The people will demand that the militia be called out for his protection.

.... Edwin Mitchell and James Hughes were summoned before a Liverpool justice accused of having obstructed a telegraph communication of the Exchange Telegraph Company. It was stated that the company conveyed messages by means of a tape, and supplied a number of betting and other clubs with racing information. The defendants took a room above one of the clubs, and carrying the telegraph wire through the window, attached it to a brass water tap, thus stopping the electric current, and preventing the club below from receiving the news of races. Mitchell was found in possession of the room when the wires were tempered with. It is the practice of these clubs to make bets up to within three or four minutes of receiving the result of the race, and the stoppage of the messages complained of would give Mitchell time to back a winner of a race with tolerable certainty at the club where the result of the race by means of his conduct had not been received. The summons against Hughes was withdrawn. Mitchell pleaded guilty, and was fined.



* * The Van Depoele electric motor is being introduced in Minneapolis on the Lyndale line.

* * Twenty-two people are killed by lightning every year in England, nine in Switzerland, and three in Belgium.

* * Several hundred acres of natural paint—sienna—have been discovered near Lewiston, Maine. Two years ago the land could have been bought for a dollar an acre. Now it cannot be bought for any figure.

* * "I was never exactly buried alive," said an old clerk, recounting his experience, "but I once worked a week in a business house that did not advertise. When I came out, my head was almost as white as you now see it. Solitary confinement did it."

* * The expression "galvanizing a corpse" has ceased to be exclusively metaphorical. M. Kergovaty, a Frenchman, has discovered a method of preserving bodies by giving them a metal coating. We may, according to our means, become silver-plated, nickel-plated, or galvanized with zinc or copper. The process has been thus far tested successfully on eleven human bodies and more than one hundred times on the carcasses of animals.

* * It is claimed that we are far in advance of any other country in the matter of weaving wire cloth, except in the exceedingly fine meshes, perhaps from 150 to 200. The palm must be awarded to the old hand-weavers of France for making such delicate webs. This indeed seems to be an appropriate name, as the wire used for such work scarcely exceeds the size of the material used by the spider in making its web.

* * The works belonging to the Palmer Wire Company, Palmer, were on Wednesday of last week sold at auction, and were purchased by J. S. Holden, of the firm of J. S. Holden & Co., woolen manufacturers, at that place. The price paid was $13,100. These works were built about four years ago at a cost of fully $130,000, and have a capacity of about twenty-five tons of finished wire per day. Through misfortune the company was obliged to go into bankruptcy last spring, since which time the works have stood idle. The purchaser, Mr. Holden, is a gentleman of large means and of first-class business ability, and will probably make arrangements for starting the same at an early date.

* * The last piece of scaffolding has been removed from the obelisk in New York's Central Park, and the giant shaft, clad in its impervious coat of paraffine, is now prepared to face with impunity the snows and rains of the next twenty-five years. So, at least, Mr. Caffall, the inventor of the process, says, and he ought to know. The effect of the coating is to make the stone a shade darker. It will undoubtedly become lighter in time, and, in fact, has already begun to grow lighter where the paraffine was first applied. The barrel of scales removed from the obelisk during the coating operation was placed in the arsenal yesterday for safe keeping. After the scales have been weighed they will probably be preserved in some museum.

* * In reference to the use of copper for roofing, an exchange publishes the following from a correspondent: "In the year 1833, fifty-one years ago, I built a house near here for my mother, and I covered the roof with eighteen-ounce copper. It is still there, and good for another fifty years, more or less. Several years ago the roof was raised four or five feet, when some repairs were made. The only disadvantage of copper after the first cost is found in the water caught from the roof being slightly impregnated with the copper, so that it becomes in a slight degree green, and possibly might be injurious to the health if used for drinking. The conductors for the rain are of copper, so that I have never felt at all anxious in storms of thunder and lightning, as the copper roof is an excellent conductor."

* * The incandescent form of the electric light, according to Dr. H. Van Heurck, affords the illumination *par excellence* for the micrographer. By means of it the observer is enabled to see details which are invisible or but imperfectly visible with ordinary light. The reason he gives for this is, first, because the electric light contains more blue and violet rays than the light of lamps or gas and, secondly, because it has a specific intensity considerably greater than other artificial light, and therefore permits the use of much more oblique rays. The electric illumination of the microscope has entered upon a new phase through the invention of the Trouvé apparatus, which can be employed for the most difficult investigations in micrography and photo-micrography.

* * In 1872 M. Gaiffe remarked that the strength of the solution in chloride of silver batteries influenced their electromotive force, a stronger solution giving a smaller electromotive force. Acting upon this hint he has constructed a cell with a solution containing 5 per cent. of chloride of zinc which gives an electromotive force of 1.02 B. A. volt, or 1.01 C.G.S. volt. It is necessary to employ pure materials, in order to keep the electromotive force of the standard cell constant. The temperature ought also to be kept constant during the time of observation, and to be the same degree in the various observations. Working with well-amalgamated zinc, pure melted chloride of silver, limpid solutions of pure chloride of zinc as neutral as possible and at the temperature of 18 deg. Cent., M. Gaiffe finds that the same solution always gives the same electromotive force. The liquor marked 107 by the densimeter appears to give the legal volt. In using the cell, resistances of at least 5,000 ohms should be used to prevent polarization.

* * Some of the most eminent architects are of the opinion that the chief source of acoustical defects in a hall is the reflection of sound waves in such a way that they strike upon the ear of the hearer within a certain interval after the direct waves, and are recognized as an echo or resonance. It is ascertained, in regard to the limits within which this point exerts a disturbing influence, that a difference of sixteen and one-half to twenty-three feet not only causes no disturbance, but, under some circumstances, may produce favorable reinforcement of the direct by the reflected sound, and that with diminished intensity the difference may be somewhat greater, but under no circumstances should it exceed thirty-three feet. In regard to the acoustic conditions of churches, it is asserted that the ceilings, which in theaters help the effect in the upper tiers, in churches are too high for this, and may produce resonance, or echo, and that it is, therefore, necessary to diffuse the sound reflected from them. Walls as well as ceilings require to be investigated in this respect.

* * The Electric Singing Luster (chandelier or gaselier) invented by the late F. Kastner, is stated to be an electric pyrophone in the form of a chandelier, lighted and worked by the medium of gas and electricity, and of which thirteen glass tubes, with their numerous small gas-burners, constitute the branches. This luster is played by means of an electromagnetic apparatus with a key-board. The electric current is transmitted by the agency of wires, concealed in the ceiling and communicating with the key-board, which may be placed in the next room, or even in a remote apartment, or another street without the audience being able to comprehend whence the music comes. Two electric singing candelabra or brass ornamented electric singing chandeliers are exhibited at the International Inventions Exhibition. They are moved by electromagnets, so that they may be played from a remote apartment and in the same manner as the luster. They are most easily transportable, and each of them may be adorned with a Geissler tube in the shape of lyre, or with small electric lamps to double the illumination.

The Electric Street Railway at South Bend, Ind.

South Bend is evidently in a state of rejoicing over her new electric railway, which is given utterance to in the following from the *Tribune*, of that city:

"The establishment of the new Van Depoele electric system of operating street railways in this city by the South Bend Street Railway Company is an event of no common significance in the history of South Bend. Through the enterprise of Mr. Lucius Clark, South Bend will be accorded the honorable distinction of being the first city in the United States to have within its corporate limits a perfect operating system of electric street railway. The enterprise is not only an honor to the fair name of South Bend, whose reputation as a manufacturing center has gone out to the four quarters of the globe, but it is creditable in a high degree to the brains and courage of its projector. The only regularly operated Van Depoele electric street railway on this continent is at Toronto, Canada, where it has been in successful operation for about two years past on the exposition grounds. A system was recently introduced at Baltimore, Maryland, but it was only inaugurated as an experiment. The same system has just been established in the exposition grounds at New Orleans. But South Bend is the first city in the United States to secure the practical application of the Van Depoele system of electric motive power on a regular street car line in a public thoroughfare. As soon as the system is successfully established in South Bend the same system will be inaugurated in Minneapolis and Detroit. The science of the application of electricity as a motive power for street cars is an established fact. It is no longer an experiment. The bray of the festive mule must go. The electric dynamo furnishes a surer, cheaper and safer power to carry busy humanity from their homes to the marts of trade than the sting of the mule-driver's whip.

"Since the big copper wire was first strung from the south end of the Michigan street line to Chapin place, thousands of conjectures have been offered by all sorts of observing people as to the principle upon which the cars would be operated and how the electricity was to be applied. The characteristic feature of these conjectures was that no two of them are alike. The curious have watched the operations of the workmen for the past few days and have propounded questions to each other until they have made one another tired. A great many wise men who do not know a dynamo from a corn-sheller, have prophesied that 'the thing won't work.' Inspired partly by curiosity and animated by a desire to benefit the readers of the *Tribune*, a *Tribune* reporter has been spending some time investigating into the merits of the system and in endeavoring to acquaint himself with the principles that underlie its operation and the manner in which the motive power is furnished.

"The principle itself is a very simple one and will be easily comprehended by those who are familiar with the science of electricity. It is only in the application of the electric current as a motive power for the cars that there is liable to be any difficulty in understanding the operation of the system. On the site of the old Huey chair factory on the Race the company have built a commodious structure, and have fitted it up for an engine house. In this house are three Van Depoele dynamos for generating the electric current. These dynamos are run at very high speed by water power. They consist of two large ones and a smaller one, the latter being used to charge the large ones. Each of the large ones is capable of lighting 20 of the large arc lights which are used in lighting our streets. From these dynamos a current is sent through the large copper wire which is suspended over the track. The current is allowed to complete its circuit by means of a wire extending from the large copper wire down to the car, where it operates an electric motor, which furnishes the motive power to the wheels of the car. From this motor the current finds its way to the wheels and from the wheels to one of the tracks through which it finds its way back to the engine house, completing the circuit. To make this track a perfect conductor, strips of brass are laid under the joints of the rails.

"The question would at once arise in the mind of a novice, how will cars pass each other with this arrangement. The device for this is very ingenious and perfect. It consists of a brass and copper frog, or switch, attached to the copper wire, which hangs directly over the frog in the track. It is so arranged that the "Traveler" passes through it on one side when going one direction, and through on the other side when returning. It works automatically, and is a perfect piece of mechanism.

"Another ingenious contrivance connected with the system is the "speed regulator," one of which is placed at the end of each car, and is operated by the driver. The regulator consists of a small cylinder on the top of which are two cranks working horizontally, after the manner of the modern street car brake, but not so large. One of these handles regulates the speed while the other regulates the current. If the driver desires a speed of four miles per hour he places the speed handle at a certain notch. Then in order to start the car the driver must operate the other handle, with which he can regulate the current and stop the car at his pleasure. The highest speed allowed by the regulator is eight miles per hour.

"This system of electrical transit is operated and established exclusively under the patents of C. J. Van Depoele, of Chicago, under whose personal supervision the plant in this city is being constructed.

About the New York Underground Commission.

Mayor Grace a few days ago addressed a letter to the Corporation Counsel, Mr. Lacombe, asking him for his opinion as to whether or not the amendments to the Underground Telegraph Bill, passed by the last Legislature, extended the time for putting the wires under ground and also whether the city authorities had any right or power to move in the matter. This request was made because of the many complaints that have been received from citizens of the dilatoriness of the Commission which now has this work in hand. The Mayor received the following answer from the Corporation Counsel:

"I am in receipt of a communication from your office referring to Chapter 534 of the Laws of 1884, and Chapter 499 of the Laws of 1885, touching the placing of electric conductors under ground, and asking whether, in my opinion, it was the intention of the Legislature to repeal by implication the provisions of the earlier of these two acts, which directed absolutely that the wires be placed under ground by the 1st day of November.

"By Chapter 534 of the Laws of 1884 it was provided that every corporation, association, or person owning or controlling telegraph, telephonic, electric, or other wires and cables (including telegraph poles and other appurtenances thereto, should, before the 1st day of November, 1885, have the same removed from the surface of all streets or avenues in every such city. In case of the failure or the owners of the property above enumerated to comply with the provisions of this act within the time specified, the local governments of said cities were directed to remove without delay all such wires, cables, etc., wherever found above ground within the limits of their cities. This act has never been repealed, and except for such qualification of it as is to be found in Chapter 499 of the Laws of 1885, it is still in force. By the last-cited act, it is expressly provided (Section 2) that the act of 1884 is (thereby) amended and made to conform in all respects to the provisions of (the later) act. This later act requires the Board of Commissioners created thereunder to cause the wires and cables to be removed from the surface and put under ground wherever practicable. No express language has extended the time within which the requirements of the earlier act are to be conformed to, and it is in my opinion very doubtful whether the provisions

of the later act, regulating the course of procedure to be followed by the Commissioners in selecting a general plan of underground subways, are so inconsistent with the earlier act as to justify the conclusion that it was the intention of the Legislature to modify it in that regard. This statute will undoubtedly have to be construed by the courts, and as the act of 1885 expressly relieves the city authorities of the responsibility of enforcing the provisions of the act of 1885, a further discussion of the question by the Law Department would seem to be unnecessary."

Mayor Grace said: "This letter fully answers my inquiry. If the city authorities have no power to act and there is a doubt about the question whether or not the time was extended for putting the wires under ground, I shall, of course, not take any further steps in the matter."

A lawyer, who has carefully studied the question involved in this law and the amendment said: "There is no doubt, in the mind of any sensible man, that the law contemplated the employment of men qualified to settle all the necessary electric and engineering questions involved in this practical new method, and not the selection of a butcher, a baker, or a candlestick-maker. There are many citizens urging the Mayor to prefer charges against the Commissioners before the Governor for neglect of duty, but this decision of the Corporation Counsel relieves him of all responsibilty. The only thing that can be done now is for some of the citizens to call the attention of Governor Hill to the delay on the part of the Commissioners and then he could refer the case to the Attorney-General for his opinion. Even then there is considerable doubt if anything could be accomplished, for if, acting on a decision from the Attorney-General, the Governor should attempt to remove these men, they could get a writ of certiorari and carry the case into the courts and keep it there indefinitely."

—— The boiler and Armington & Sims engines for the incandescent company's central station have arrived at New Bedford. The Jarvis Engineering Company, of Boston, have the order to erect the plant.

——The United States Electric Lighting Company have recently contracted for a plant of 1,000 sixteen-candle lamps for the building owned by the Equitable Life Insurance Company, of St. Louis; a 300-light plant for the packing house of Fowler Bros., Kansas City, Mo., and a 50-light plant to go to a party residing near the Rocky Mountains. This company is doing a splendid business, and their western representatives are evidently wide-awake men. In the enterprising and growing Kansas City the United States people have secured quite a business, and all their patrons are, of course, satisfied with the light.

—— At the meeting of the Aldermanic Committee on Public Lighting, at Detroit, Charles M. Swift, attorney for the Brush Company, stated that according to the Controller's figures the city had lost 1,868 hours of lighting the past month, which was due to the carelessness or inexperience of the men in fitting the carbons; but on the other hand the Brush Company had put up seven extra lights, which had given 2,187 hours of lighting not called for by the contract. In addition,to these extra lights, the company had also furnished one arc and two incandescent lights in the market building and the City Hall. The committee, after consideration, agreed to report in favor of putting up lights at $200 each per year—$2,200 in all—on the following corners: Brush and Atwater; Eighteenth-and-a-half and Woodbridge, Jay and St. Aubin; Fourteenth and Dalzell; Beaubien and Harper; Fort and Monroe; Seventh and Congress; Russell and Catharine; Russell and Ferry; Macomb and Rivard; Montcalm and Park. The seven extra lights already put up without pay are at the corners of Croghan and Campau; Moran and Fremont; Sixteenth and Grand River; Woodbridge and Fifteenth-and-a-half; Woodward and Brady; Tenth and Lafayette; Larned and Third.

—— At Erie, Pa., we learn that the Schuyler Electric Light Company, of Hartford, Conn., is about to locate a plant. Fifty patrons are already pledged to support the competitor, and the plant is expected to be ready for operation within a month.

——Mr. H. S. Thornbury, for several years connected with the electrical department of the American Bell Telephone Company, has accepted a position with the Consolidated Electric Light Company of this city. In securing the services of Mr. Thornbury, the Consolidated Company have made a wise move, and the electric lighting field gains a capable and energetic worker.

—— The necessary plant for lighting the Low Moor Colliery, England, by electricity, is now being prepared, and the whole of the apparatus is to be erected at the bottom of the pit. Permanent wires are being fixed along the principal roadways from the shaft to the extreme end of the workings, while branch wires—which are movable, so that the miners can shift the lamps from place to place as they work—extend on either side into the several workings. The lamps used are of the incandescent form, inclosed in a stout glass globe, which is further protected on the outside by wire work. A small switch in connection with each lamp will allow the workman to reduce or increase the amount of light at pleasure.

—— The Bridgeport *Standard* in endorsing the action of the Mayor in ratifying the contract with the Bridgeport Electric Light Company, says: "We believe that in this matter Mayor Pyle has done what was strictly his duty. It will be seen that the terms and limitations of the proposed contract are very different from what they have been represented by those who have fought the Bridgeport Electric Light Company all through. If, on the score of economy, it is thought necessary to reduce the lights, that can be done under the contract to or below the cost of gas. But the people do not want any such reduction now; they do want the electric light and propose to give it a fair trial. Were a vote taken to-day among the legal voters of Bridgeport on the subject it would be ten to one in favor of the electric light at its present cost. Mayor Pyle has made himself acquainted with the state of public opinion on this point and acts in the direction of it when he puts his official signature to the ratification of the minutes. The provisions added to the proposed contract by the Board of Aldermen at the instance of Alderman Parrott, secure the city and guard its rights, and the people want the light."

—— The wires for the incandescent street lights, which are to supersede gas in Lawrence, Mass., are now all stretched with the exception of the South Side, Essex street and the Common. In these localities the wires will very soon be extended. Some delay has been experienced in putting in the new engines. One of them when it arrived was found to have met with an accident on the way, and it was necessary to ship it back to the manufacturers, Messrs. Armington & Sims. It is expected back in a day or two repaired. It has also been difficult to procure supplies of wire, etc. All firms dealing in electric-light materials, being at present, and for some time past, driven with orders. It is stated that in the last month over 8,000 electric-lights have been put in throughout New York and New England. Nearly all the wire used in electric-lighting is made in Ansonia and Waterbury, Conn., and such has been the demand that many orders have been greatly delayed in being filled. Nearly all the preliminaries for starting up the lights, have now been completed, and the engines will in a few days be ready to run. There are in all, five of these, three old ones and two new, all of the Armington & Sims make. The new ones are 90 horse-power, running 280 revolutions a minute. It is thought that the lights will all be in operation by next month. The lights which burn all night are to be 16 candle-power, and those on the bridges 32 candle-power. The others will be 10 candle-power.

——It has been resolved, from the first of January, to allow war ships and postal steamers fitted with electric lights to navigate the Suez Canal, between Port Said and Suez, at a rate of speed not exceeding fifty-four kilometers per night.

——A new idea proposed in connection with the electric light in Brooklyn is to light the skating area on the lake in the Park, when the ice is formed, by electric lamps suspended high overhead. The change this will afford from the dull illumination given out by the oil lamps which have lined the borders of the lake for the convenience of skaters, will be highly appreciated. The lights would also be a great addition to the lake on summer nights when the boats are in use.

—— At a meeting of the stockholders of United States Electric Lighting Company, at Washington, D C., the following Board of Directors was chosen for the ensuing year: John A. Ruff, C. F. Norment, James L. Barbour, Frank B. Conger, William Dickson, Samuel Norment, A. M. Renshaw, Seymour W. Tulloch and Matthew E. Emery. The officers elected were: Samuel Norment, president; M. G. Emery, vice-president; Wm. Dickson, secretary; Seymour W. Tulloch, treasurer; and A. M. Renshaw, manager.

—— The transfer of the arc-light dynamo to the second story of the electric station was completed at Wilmington, Del., last week, and the lights are now burning as usual. Work on the apparatus and machinery for the incandescent lights, which will occupy the first floor, will now be pushed rapidly forward. The work is being done under the personal supervision of Manager S. N. Trump and Superintendent Oakley Purdy, of the Arnoux Company, and Electric Engineer F. S. Andrews, of the incandescent company.

—— Messrs. Armington & Sims, the widely known engine builders of Providence R. I., have issued a very elegant and comprehensive catalogue, containing a supplement which gives tables of their engine as adapted for the different systems of electric lighting to drive direct on dynamos—a field in which this engine has met with wonderful success. The front cover consists of a striking engraving suggestive of the development of the steam engine from the rude Hero type to the perfection of the present day.

—— The Brooklyn owners of fast and other horses—those especially who live in the Eastern District—will hereafter on their return from the Park or Coney Island, be lighted part of the way by electricity. Charles Cooper, President of the Citizens' Illuminating Company, states that all the arrangements have been completed. The plaza on Flatbush avenue, at the principal entrance to Prospect Park, will be lighted by eleven electric lamps, and thirteen have been placed on Sackett street boulevard, between the plaza and Bedford avenue.

—— At Wilmington, Del., the following directors of the Arnoux Electric Light Company have been elected for the ensuing year: S. H. Grey, Wm. W. Pusey, S. N. Trump, Joseph Pyle, J. H. Hoffecker, Jr., H. C. Robinson, J. R. Flinn, F. B. Colton and J. D. Sisler. The board organized yesterday by the election of the following officers: President, S. H. Grey, of Camden, N. J.; Vice-President, William W. Pusey; Treasurer, H. C. Robinson; Secretary, F. L. Gilpin. It is hoped to have the incandescent lamps burning in about one week.

——The Jarvis Engineering Company, Boston, Mass., are busy erecting steam plants for electric-light companies. They have orders from the Edison Co., New Bedford, Mass.; Thomson-Houston Co., Haverhill, Mass.; Thomson-Houston Co., Woonsocket, R. I.; Schenectady Gas Light Co., Schenectady, N. Y.; Thomson-Honston Co., Trenton, N. J.; Thomson-Houston Co., Providence, R. I.; Jenney Electric Light Co., Fort Wayne, Ind.; Brush-Swan Electric Light Co., Greeley, Col.; Jenney Electric Light Co., New Orleans, La.; United States Electric Light Co., Washington, D. C.; Thomson-Houston Co., New-Haven, Conn.

ELECTRIC LIGHT NEWS

——The Brush Electric Illuminating Company, of New York, has declared a semi-annual dividend of 3½ per cent.

—— The incandescent lamp on the arc circuit is being introduced in Worcester by the Thomson-Houston Company.

——An electric-light plant is to be installed at Rio Claro, Brazil, the first of the month. The machinery recently arrived from the United States.

—— Binghamton, N. Y., proudly points to the incandescent light to be seen at H. B. Darrow's business house, and which has just been installed.

——Messrs. F. W. Kinsman & Co., of this city, are doing some extensive and elaborate jobs of electric-light wiring. They recently did all the wiring for a large plant in this city, consisting of 70 arc lights and 600 incandescent, the work being done in a first class manner.

—— The Brush Electric Company have their plant at the New Orleans Exposition in good order. Two engines which run the dynamos are working as well as they possibly can, and the lights go up punctually every night. The Music Hall will soon be brightly illuminated.

——There is very much competition going on at Clinton and Lyons, Iowa. The Brush, United States, Thomson-Houston, Western Electric and Van Depoele are all represented, some of the gentlemen remaining on the ground all the time. The final decision will soon be announced, and may the best man win.

—— At Treberg, the well-known clock-making town in the Gutach Valley, Germany, the celebrated waterfall has been utilized to drive a turbine, and the electric light is now supplied to the town at a cost in excess of the expense incurred by the use of petroleum lamps; but it is said that more than ten times the amount of light is given.

—— An electric stud is one of the latest novelties of this inventive age. The diamond forming the stud has a cavity in the center. This forms the receptacle for a tiny electric lamp. Stored electricity can be carried in the waistcoat pocket, and when switched on to the stud-lamp it greatly intensifies the brilliancy of the diamond, producing a splendid effect.

—— The Shultz Belting Company, of St. Louis, have just issued a neat, four page circular, calling attention to the general excellence and great driving power of the Shultz belting, and its particular adaptation for electric-light work. The endorsement of several leading electric-light companies and price list of the belting are published in the circular, which will be sent to all companies asking for the same.

—— At Muncie, Ind., the engine and poles have been put in for the electric light for Boyce's bagging factory, residence and business block, all of the churches, three street lights and a large number of stores and residences. Four hundred lights are said to have been ordered. The gas company are putting down the price of gas and threaten to also put in an electric-light plant. From present indications, light will be cheap in Muncie.

——A boiler repairer says: "A soft patch is a temporary expedient for stopping a leak, but in many boilers which have become wasted through long service, it is about the only thing which can be used, as there is no good metal to rivet to anywhere near the leak, and it would be impossible to make a job of riveting that would bear the strain of caulking. The patch, if on the outside of a boiler or removed from the fire, may be applied as a plaster directly upon the iron without cutting away the defective part; but if over or near the fire, the defective part should be cut away, so that the water may have access to the sheet of the patch.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING NOV. 17, 1885.

330,064 Gravity telephone switch-board; Charles E. Scribner, Chicago, Ill., assignor to the Western Electric Co, Chicago.

330,065 Telephone exchange switching apparatus; Charles E. Scribner, Chicago, Ill, assignor to the Western Electric Co., Chicago.

330,066 Toll-line apparatus for telephone exchanges; Charles E. Scribner, Chicago, Ill, assignor to the Western Electric Co., Chicago.

330,067 Multiple switch-board for telephone exchanges; Chas. E. Scribner, Chicago, Ill., assignor to the Western Electric Co., Chicago.

330,071 Electrical conductor; Anson C. Tichenor, San Francisco, Cal.

330,074 Electric alarm for locomotives; William Vogel, Chicago, Ill., assignor to Adolph Zeller, Chicago, Ill.

330,095 Dynamo-electric machine; Ernest P. Clark, Owego, N. Y.

330,139 Electric laryngoscope; Curt W. Meyer, New York, N. Y.

330,173 Means for supporting electrical wires; John W. Tringham, Windsor, Ontario, Can.

330,226 Testing and firing apparatus for submarine mines; Joseph P. Gibbons, 4 Osborne Terrace, Coombe Farm Lane, Westcombe Park, County of Kent, assignor to Latimer, Clark, Muirhead & Co., 23 Regent street, Westminster, England.

330,238 Transmitter for printing telegraphs; Clarence L. Healy, New York, assignor to Stephen D. Field, Yonkers, N. Y.

330,239 Transmitter for printing telegraphs; Clarence L. Healy, New York, assignor to Stephen D. Field, Yonkers, N. Y.

330,244 Regulator for electric lights; Phillip Lange, New York, N. Y., assignor to Bergmann & Co., New York.

330,247 Carbon electrode for electrolytical purposes; Henry Leipmann, County of Middlesex, England.

330,344 Automatic perforating telegraph; James E. Munson, New York, N. Y.

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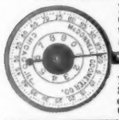

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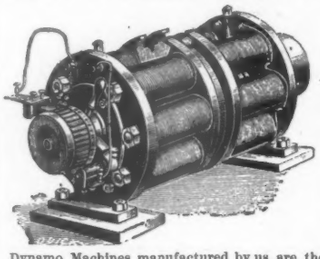

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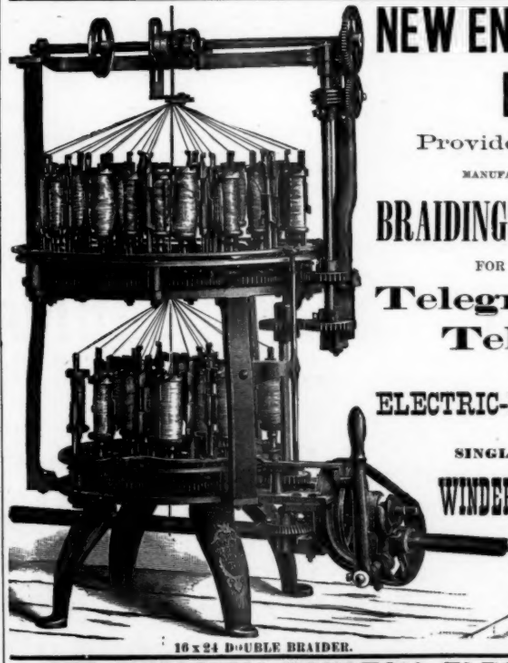

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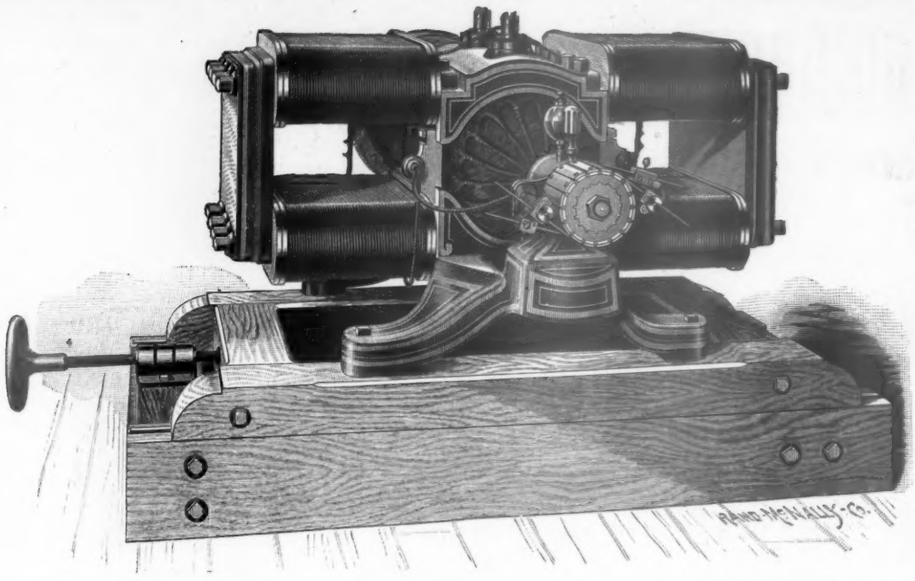

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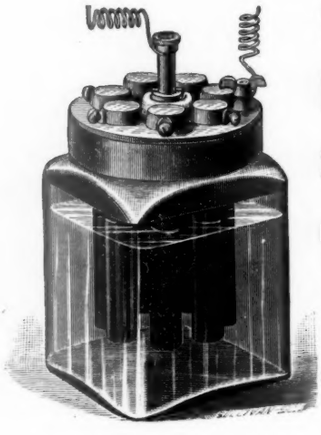

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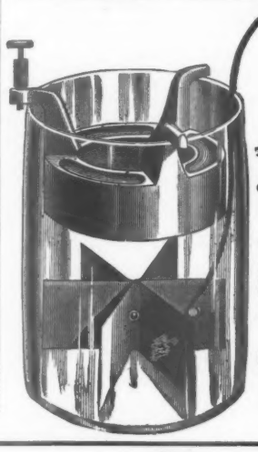

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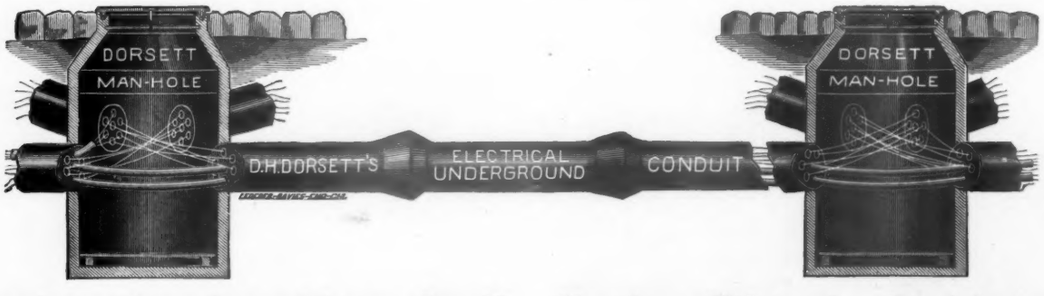

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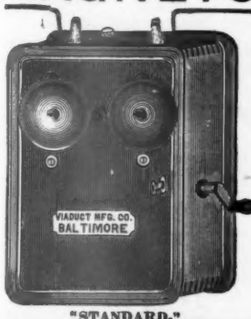

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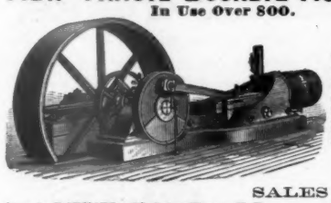
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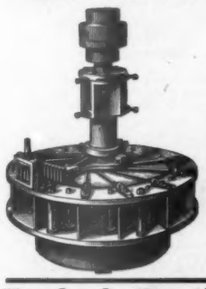
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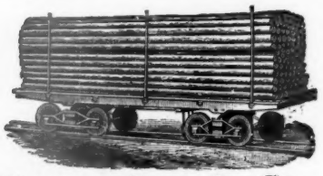

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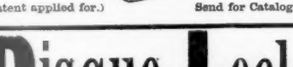

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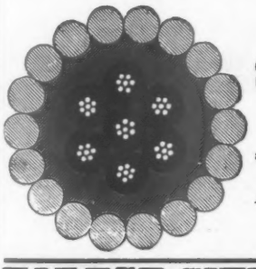

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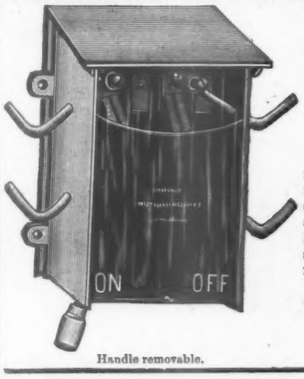

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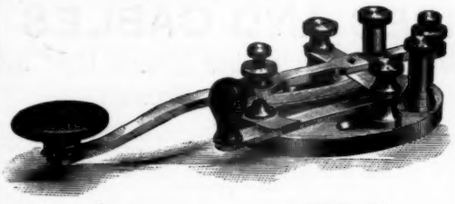

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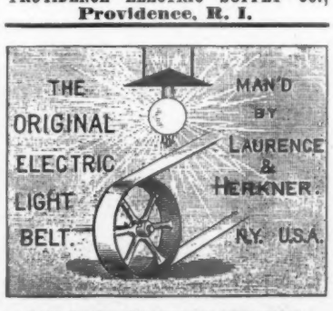

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